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ABSTRACT

Approximately 130 community colleges in the U.S. are designated as Hispanic Serving Institutions (HSIs). The Census Bureau predicts that there will be approximately 21 million Hispanic residents in the U.S. by 2025. A total of 55% of Hispanic students seeking undergraduate degrees are enrolled in community colleges. Therefore, it is critical that community college faculty and administrators recognize the role they play in ensuring the success of Hispanic students in the science, mathematics, engineering, and technology (SMET) disciplines. Estrella Mountain Community College (Arizona), with a grant from the National Science Foundation, hosted a group of leading SMET educators representing HSI community colleges. This report provides an overview of the presentations made and recommendations developed during the two-day meeting. A report by the Western Interstate Commission for Higher Education predicts that the Latino high school enrollment will increase by 137% between 1995 and 2012, while the white/non-Latino enrollment will decrease by 12.5%. Among the recommendations made in this report are: the National Science Foundation should request $20 million from Congress for new grant programs for HSI colleges; schools should set high standards for their students; and Hispanic families and communities should be involved in all stages of education. The digital divide is also discussed, along with the role of K-12 education, institutional cooperation, and faculty preparation. Participating campuses' best practices are included. (NB)

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ED 466 277

A NATIONAL SYMPOSIUM ON

BEST PRACTICES FOR STUDENT ACHIEVEMENT IN SCIENCE, MATHEMATICS, ENGINEERING, AND TECHNOLOGY IN TWO-YEAR HISPANIC-SERVING INSTITUTIONS (HSIs)

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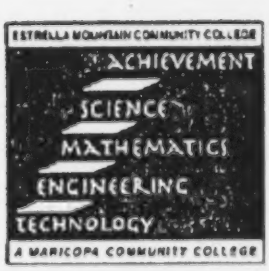

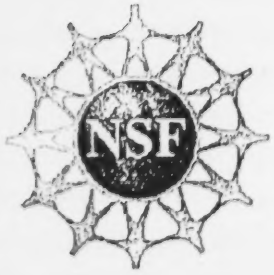

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EXECUTIVE SUMMARY

This report acknowledges the wealth of information and "best practices" currently available to science, mathematics, engineering, and technology (SMET) educators in colleges and universities. However, it also highlights the special needs of the growing number of Hispanic students, and makes recommendations for the National Science Foundation and the two-year colleges that serve Hispanic students nationwide.

The report notes, for example, the importance of reaching out to the earliest grades, not just high school, to ensure that SMET education is a "seamless" experience for all students. The report also points out the importance of involving Hispanic families and communities in all stages of education, and recommends that minority "ambassadors" speak to families and community groups about the opportunities in SMET careers in general and the programs at local community colleges in particular. Once students are on campus, the report notes that students need to learn how to acquire knowledge, since this was identified as the most important SMET skill of all. Matriculation is also a key concern for two-year colleges serving Hispanic students; developing strong transfer links to universities and to employers can help ensure student success.

The report then details a list of recommendations for the National Science Foundation to support the development and implementation of these best practices. These recommendations include supporting:

- SMET programs in K-12 schools, particularly those serving Hispanic students;
- programs that reach out to the Hispanic community;
- teacher preparation and professional development programs;
- programs that build bridges between K-16 institutions;
- publication and dissemination of what works;
- Hispanic students pursuing SMET studies;
- community college faculty;
- the integration of technology into all educational activities;
- programs that reach out to industry; and
- new programs for Hispanic Serving Institutions (HSIs) to implement the recommendations in this report.

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INTRODUCTION

With a grant from the National Science Foundation, Estrella Mountain Community College hosted a group of leading science, mathematics, engineering, and technology (SMET) educators representing two-year colleges serving Hispanic students. Faculty from community colleges as far away as New York and California were brought together to 1) share the successes they've had on their campuses ensuring Hispanic student achievement in SMET disciplines, and 2) discuss the challenges they still face when serving Hispanic students.

To initiate the discussion, faculty and staff at Estrella Mountain Community College developed an overview of SMET "best practices" summarized from the SMET literature (see Appendix 1). For the purposes of the discussion, best practices were defined as any program, approach, or method proven to be successful in helping to ensure student achievement in science, mathematics, engineering, and technology. Participants were asked to identify which best practices were relevant (and which were not), and which needed to be better defined to meet the needs of Hispanic students based on the participants' experiences (see Appendix 2 for an overview of some of the best practices from participating campuses).

In addition to the formal and informal discussions, Congressman Ed Pastor welcomed the group and noted the importance of the meeting, and noted speakers Dr. Baltazar Acevado, Jr., Dr.Alfredo de los Santos, Jr. and Dr. Gerardo de los Santos, and Dr. Manuel Berriozábal presented background information on demographics, the "digital divide," and TexPrep, a highly successful program replicated in nine states. These presentations, presented as Appendix 3, helped provide background information and lay the foundation for the group's primary assignment: to develop a set of guidelines and best practices for the National Science Foundation and others committed to the success of Hispanic students in science, mathematics, engineering and technology.

Approximately 130 community colleges in the country are designated as Hispanic Serving Institutions (HSIs). As Dr. Norman Fortenberry noted in his opening remarks, community college students comprise 55% of Hispanic students seeking undergraduate degrees. And, as Dr. Baltazar Acevedo pointed out, the Census Bureau projects that the United States will have approximately 21 million Hispanic residents by the year 2025. It is therefore critical that all community college faculty and administrators, particularly those at the HSIs, recognize the important role they play in ensuring the success of Hispanic students in the SMET disciplines.

The following report provides an overview of the presentations and recommendations developed during the two-day meeting. It is not meant to be a comprehensive, word-by-word transcription of the symposium, but rather a guide for NSF and others interested in identifying and implementing SMET best practices to better serve Hispanic students in their schools, colleges, and universities.

NSF WELCOME

Dr. Norman Fortenberry, Director
National Science Foundation Division of Undergraduate Education

In a 1991 article, Washington Post columnist David Broder wrote that "More than any other single question, the challenge of educating and training the workforce for the new economy will determine what future America has – or whether it really has a future." Community colleges, more than any other segment of higher education, have stepped up to meet that challenge. The more than 1,000 community colleges in this nation enroll 47% of the nation's first-time freshmen and 45% of all undergraduates. Community college students comprise 55% of Hispanic students seeking undergraduate degrees, 40% of Native Americans, 42% of African Americans, and 40% of Asians/ Pacific Islanders. Forty-five percent of the women seeking undergraduate degrees are enrolled in community colleges and more than half of community college students are among the first in their families to attend college. From the perspective of the National Science Foundation, it is critical to note that 10% of doctoral recipients in math and science began in a community college.

A 1998 study funded by the Education Commission of the States reveals that governors believe that community colleges are unquestionably the most responsive segment of higher education in meeting fundamental state needs. Of the governors surveyed, 69% rated community colleges as "responsive" and "very responsive" compared to only 46% providing similar ratings for the next highest group, public research universities. Seventy percent of the governors believed that directing more students to attend a community or technical college for their first two years represented a preferred strategy to cope with increased access demands. Thirty-six percent of the governors supported the idea of community colleges offering high-demand four-year degrees and 94% supported the use of technology to deliver more course offerings.

The importance of community colleges is also acknowledged in a study, Returning to Our Roots, by the National Association of State Universities and Land-Grant Colleges (NASULGC). This report, which also emphasizes the role of educational technologies, recommends that state research universities "form partnerships with other institutions, especially community colleges, to provide high-quality academic programs and services to students in cost-efficient and accessible ways."

Community colleges are also being increasingly recognized for their role in community development, outreach, and education. For example, Estrella Mountain Community College has had its Center for Teaching and Learning

recognized by the League for Innovation as a "Classroom of the Future." EMCC is one of several exemplary institutions within the Maricopa Community College District supported by the National Science Foundation because of its demonstrated strength and the extent of their community college engagement of the broader community. NSF grants to colleges in the Maricopa District demonstrate outreach to K-12, engagement of the business and industrial sector, curricular restructuring to enhance learning for all students, and alignment with baccalaureate degree programs. EMCC and the Maricopa district are especially noteworthy because they serve a large Hispanic population, as do the other institutions represented at this meeting.

Community colleges with significant enrollments of Hispanic students are particularly important to maintaining the technological leadership this nation enjoys and the rich economic benefits that accrue from that leadership. Why? Because two-year HSIs enroll 52% of all Hispanic students in higher education. If we wish to obtain more Hispanic representation among the ranks of trained technical professionals, we need to engage your institutions and strengthen your ability to deliver the highest possible quality education in science, mathematics, engineering, and technology. The National Science Foundation has not done such institutional capacity building with Hispanic Serving Institutions since the 1981 Reagan White House essentially eliminated support for pre-college and undergraduate education the National Science Foundation. The Minority Science Infrastructure Program was moved to the Department of Education where it now operates with a total budget in the range of $10 million. Thankfully, with strong Congressional support, NSF has reestablished its higher education programming. Particularly relevant to this meeting was the 1998 appropriation language establishing the Historically Black Colleges and Universities Program at $10 million. That program now has a budget of almost $15 million. Last year, the Clinton White House, under significant pressure from tribal colleges, augmented the NSF budget request with a $10 million Tribal Colleges and universities program. I believe that a member of the Hispanic Congressional Caucus had a discussion with NSF's leadership about the creation of a Hispanic Serving Institutions program.

There are three lessons to take home from this. First, NSF is not the sole actor in determining what is in its budget. The White House and, particularly, the Congress play dominant roles. Second, significant budget increments rarely occur within existing programs without external intervention. Finally, once a program is established, it is up to its constituent community to maintain its health and vitality. I'd like to make one final observation. In its budget documents for this year, the Foundation has signaled that it is not opposed to the recreation of an integrated Minority Serving Institutions program. This could parallel the integrated nature of the Louis Stokes Alliances for Minority Participation program, which would allow managerial flexibil-

ity in meeting the needs of the various constituent communities. Or, it could be kept as a separate program to aid in visibility and accountability. I think it important that you make known your support for the core concept of enhanced opportunities for to HSIs and not get dragged into nitpicking over the form of those opportunities.

I look forward to reading the report resulting from this meeting and in particular will be looking for the answers to these three questions: 1) what works and can be institutionalized? 2) how can external funding be catalyzed; and 3) how can NSF do better for Hispanic Serving Institutions?

DEFINING BEST PRACTICES FOR HISPANIC SERVING INSTITUTIONS

"When approaching these best practices, it's important to remember who our students are and why they are having trouble. Our ultimate goal should always be to find the best methods to help our students succeed in science, mathematics, and technology." Dr. Sandy Zetlan, Professor of Biology and former chair, Science and Mathematics Division, Estrella Mountain Community College

Introduction

In preparation for the symposium, faculty, administrators and staff at Estrella Mountain Community College conducted an extensive literature review of existing best practices in science, mathematics, engineering, and technology. Publications reviewed in this process included *Best Practices: Improving the Preparation of our Nation's Science, Mathematics & Technology Teachers* (NSF, 1999); *Investing in Tomorrow's Teachers: The Integral Role of Two-Year Colleges in the Science and Mathematics Preparation of Prospective Teachers* (NSF, 1998); *Shaping the Future: New Expectations for Undergraduate Education in Science, Mathematics Engineering, and Technology* (NSF, 1996); *The Status of Science, Engineering, and Mathematics Education in Community, Technical, and Junior Colleges* (American Association of Community and Junior Colleges, 1991); *Lessons for the Future: Minorities in Math, Science, and Engineering at Community Colleges* (American Association of Community and Junior Colleges, 1993); and *Synergy: Advancing Technological Education* (NSF, 1999) (see Appendix for the resulting summary and bibliography).

As these and other publications make clear, over the last decade educators and educational policy makers have identified, developed, and demonstrated a core group of these best practices and strategies for implementing them with the goal of helping students succeed in science, mathematics, engineering, and technology studies. These practices and strategies include everything from incorporating active learning and inquiry into all science, mathematics, engineering, and technology (SMET) courses, to providing educators at all levels (K-16) with more professional development opportunities to improve their understanding of content, methods, and new assessment techniques. When reviewing and compiling these practices, faculty and staff at Estrella Mountain grouped them into the three stages through which a student progresses, starting in their early school experiences where students' natural love of discovery should be nurtured, their years at the community college where retention is critical, and finally their successful matriculation to four-year colleges or the workforce.

Starting with this initial listing of best practices defined for all SMET students, which the reviewers identified as also relevant for Hispanic students, participants at the symposium were asked to recommend changes, deletions, and/or additions to the list to ensure the success of all Hispanic SMET students. Then, using their revised list, participants met in six break out sections where they reviewed and reflected upon these best practices and implementation strategies with the goal of answering the following three questions:

1) which of these practices would apply to their own two-year Hispanic serving institutions?
2) what are the challenges to implementing these best practices in their institutions? and
3) what would be the best strategies for implementing these best practices in their own schools?

The following provides an overview of their discussions and recommendations.

Best Practices
to Help Ensure Hispanic Student Success in
Science, Mathematics, Engineering, and Technology

Stage 1: Helping Hispanic students matriculate from the high school to the community college: practices and programs that recruit and prepare students for success in science, mathematics, engineering, and technology.

During their initial discussion of the best practices compiled for the symposium, participants noted that the first stage should include the earliest grades (not just high school) to ensure that SMET education is a seamless experience. "We need to view ourselves as a learning community," one participant noted, with no breaks between any of the levels of education, so that students experience continuity and see collaboration at all levels. Plus, another participant emphasized, if educators don't do a good job in the earlier grades, community colleges end up with a "bottleneck" of unprepared or under-prepared students.

Many science and mathematics teachers did not major in the subjects they are teaching, it was noted, so professional development opportunities are critical if the goal is to improve the quality of SMET education. However, teachers already have full plates. For teachers to be able to participate in professional development workshops and courses, as well as work in collaboration with community colleges, support is needed to provide classroom and other relief. Otherwise teachers cannot be expected to take on extra education and administrative tasks.

The importance of educating teachers about Hispanic culture was also noted. It is extremely important for teachers to understand the family-oriented culture of Hispanic students, and to be able to work with families to ensure all students' success. Emphasizing social and cultural awareness can make educators much more effective.

It is also important that policy makers, educators, and others be continually reminded of the demographic changes underway which will have a huge impact on education, particularly the education of Hispanic students. It was also noted that NSF does not fund programs to address these kinds of critical K-12 issues.

Other best practices discussed during the breakout sessions included:

Developing strong links to elementary, middle school and feeder high school

Many participants in the discussion group pointed to the many successful programs where "the lines are blurred" between high school and community colleges. These innovative best practices allow bright high school students to participate in dual enrollments thus earning college credit while still in high school. This "bridge" helps create a familiarity with college campuses and programs and makes for a much easier transition.

Another successful practice noted by participants is bringing elementary school students to the community college campus and giving extra credit to community college students if they make a presentation in a K-9 school. This two-way exchange puts a "human face" on science. It also provides community college students with first-hand experiences in the classroom, often encouraging students to consider teaching as a career.

Community college faculty and counselors also need to interact at least twice a year with their peers at feeder schools to ensure that high school teachers and counselors are kept abreast of changing academic requirements and workforce needs. They also can exchange information on curriculum changes, new teaching methods, and scholarships and other financial aid programs.

Involving the parents and family in the educational process

Breakout groups noted the importance of involving parents and extended families in every step of the process. For example, invite parents of students to attend pre-college counseling sessions, to student and parent orientation days (e.g., to discuss transfer requirements, financial aid, etc.), to student recognition days, and to special classroom presentations designed for families. It's also important to invite parents' input and reach out to the community through college ambassadors and other outreach programs.

To involve parents and family members in the educational process requires time, money, and additional staff to coordinate programs. It also requires an administrative commitment at the HSIs to ensure that time and resources are available.

Supporting professional development programs for high school teachers in SMET

It is essential that those teaching mathematics and science *know* mathematics and science. Even those trained in college in the SMET disciplines can still profit from on-going professional development opportunities. These programs can be used to build confidence in SMET disciplines, create an awareness of things that work, and provide opportunities for teachers from multiple disciplines and multiple institutions (e.g., middle school, high school, and community college) to collaborate and learn together. Such a process can help build community and a learning infrastructure within that community; it can also help build and strengthen programs designed to link high school students to their local community colleges.

Implementing professional development programs can be difficult because of lack of funding, lack of networking, high school scheduling, and diverse priorities in certification. Distance learning is one alternative, providing asynchronous learning opportunities that are not place bound. To motivate teachers to participate in these kinds of programs it was suggested that content and methods workshops be linked to certification requirements.

Ensuring availability of appropriate instructional technology

If students are expected to succeed in SMET courses, up-to-date technology needs to be integrated early on to enhance the learning process. For this to be successful, however, teachers need support to ensure that the technologies work; they also need appropriate instructional training on how to more effectively infuse technology into the classroom. Many also noted the importance of opening the doors to the community to ensure access to technology whenever possible.

Funding will always be a major challenge to getting technology into the classroom and keeping that technology current. Training and technical support will also be continual challenges. One way to ensure the availability of technology is to create partnerships with the community and local businesses to get technology into the hands of students early on. Foundations can also be a source of support, as can shared facilities at local community colleges. On-going training and demonstration programs can also help teachers stay abreast of new technologies.

Stage 2: Retaining Hispanic students in the community college: programs and services designed to help Hispanic youth succeed in lower division courses

During the general discussion on the second stage, many emphasized the importance of setting high standards to ensure that students learn early on the importance of hard work and scholarship, and to ensure that they develop the work and study ethics needed to succeed. Science and mathematics can be fun and exciting, it was noted, but no one should pretend that mastery doesn't take hard work and commitment. As one participant put it, "self esteem should come after self efficacy." Throughout the group discussions the importance of continuing the dialog between elementary and secondary schools, community colleges and four year institutions was stressed.

Common to all stages, the group again emphasized the importance of involving Hispanic families and communities in all stages of education. In particular, it was recommended that community colleges enlist minority "college ambassadors" to speak to families and community groups and to greet families and students when they visited their campuses. Another successful practice highlighted by participants was group advising for Hispanic students who have first been separated by gender so that the students feel freer to talk.

Hispanic cultural awareness training for community college faculty and administrators is critical, it was advised, as is involving policy makers in discussions about the future of Hispanic serving institutions which are trying to meet the educational needs of the Hispanic community often with limited funds. There is also an overwhelming need to keep everyone, from local communities to policy makers, aware of changes in demographics. Other best practices and strategies discussed included:

Improving student confidence by providing networks with peers, faculty and staff

Several different methods for establishing student confidence were discussed by breakout groups. Student clubs and organizations with consistent schedules that do not interfere with classes have proven to be very successful in encouraging student participation on campus. These can function like "second families," it was noted. Peer mentoring and peer support groups can be particularly effective, it was noted. Student organizations designed to track students' progress, with students serving as peer tutors, role models, etc., have also been successful.

Faculty, too, should be involved in student clubs. One participant noted that when faculty rotate through more than one club, students are introduced to

faculty members and have a greater feeling of campus-wide support. Parent orientation nights, some specifically designed to serve bilingual families, have proven successful in involving families in the learning community.

The two greatest barriers identified to improving Hispanic student confidence while attending community colleges are limited familial history with higher education which limits parent participation and, thus, support for students and the students themselves, who often view grades as something "given" to them rather than earned. Other barriers include the need to earn a living (rather than placing a value on education), lack of time to be involved in a learning community for both faculty and students, and the stress students face having to balance home and school. This is particularly true of single mothers.

Ways to overcome these barriers included making sure standards are communicated early (e.g., in elementary and middle schools) and that students learn early about the value and importance of education. There's also a need for more programs designed to highlight successful minorities and create role models. More outreach and support for students (not just tuition support) are needed to ensure that all students are aware of the value of education and have an opportunity to pursue one.

Improving counseling and advising

Participants agreed that counseling and advising should begin early, parents and other community members should be included at every step, and advising should continue throughout a student's academic career to help track their success. Colleges should invite middle school students and their families to campus, to introduce them to the campuses at an early age and to encourage students to prepare for advanced studies. In TexPrep programs, it was noted, liaisons work directly with local high school students; in 2+2 programs at participants' campuses, high school students work with college advisers starting in their junior year. Counselors can also help students identify scholarships for pursuing SMET degrees.

The top challenges to implementing effective counseling and advising programs include the need to improve communication between faculty and the counseling staff, the difficulty for counselors to stay up to date on continually changing requirements, and the lack of knowledge middle and high school counselors often have regarding SMET careers and special programs. Counselors also need to be available beyond traditional 9-5 office hours to better serve the non-traditional students attending community colleges. One suggestion for overcoming these barriers is to create online systems that provide updates on transfer requirements, scholarships, etc. Counselors also need better training and more time for formal and informal communication.

Providing role models/mentors to interact with students

Mentoring can and should play a significant role in helping to ensure students' success. Participants pointed to a number of successful programs on their campuses that helped provide role models and/or mentors for students. One-on-one and small group mentoring programs with faculty, peer tutoring, linking senior students with juniors, and community college students with students at four-year institutions have all been successful. TexPrep, Bridges to the Future, and the Math, Engineering & Science Achievement (MESA) programs were pointed to as models in this regard. Hiring minority graduate students to work with community college students can help students see that it is possible to succeed in higher education, it was noted.

The top challenges to implementing mentoring programs are a lack of diversity in faculty and administrative roles to serve as mentors and lack of institutionalization of mentoring programs which are too often funded in short cycles. Lack of external funding for mentoring programs, and low number of students available to work as mentors, were both noted as barriers. Clearly, more training and funding is needed for faculty to serve as mentors and there needs to be more widespread administrative support for these kind of programs. Participants also recommended that hiring practices be modified to ensure that more minorities and women are hired in all levels of science, mathematics, and technology education. It's important to "de-myth" the widespread belief that educational institutions "can't find qualified people of color in science and math."

Ensuring that students have the basic skills to succeed in college math and science courses

The foremost "basic skill" identified by participants is the ability to acquire knowledge. This is closely aligned with developing study skills and orientation on how to be successful in science, mathematics, and other courses. Others noted that in addition to having quality SMET courses, they also need access to expanded study hours and walk-in tutoring programs to help ensure their success.

In mathematics, which provides a necessary foundation for all the other science and technology disciplines, some students need opportunities to attend "math boot camp," and/or work with interactive software programs which identify areas of deficiency and develop individualized work for students to improve their abilities. Modular and/or self-paced math courses can also help in this regard, by ensuring that students master a specific concept before moving forward to the next module or unit.

According to the group, the top two challenges to implementing these kinds of programs are lack of funding for qualified tutors and smaller class sizes, and non-alignment of teaching assignments with academic background/preparation at high school level. Unless hiring standards are enforced at the high school level for SMET teaching, students will continue to be under-prepared and will require extra help when they reach the community colleges. More incentives also need to be in place to encourage more teachers to enter mathematics and science teaching as a career.

Another challenge is that many students are bilingual and English is a second language. For bilingual students, translating complex science and mathematics terminology can be difficult. To meet that challenge, offer some bilingual SMET classes and/or offer tutoring with faculty and peers who speak the student's native language.

Offering appropriate SMET pedagogies for student success

Many participants pointed out that small, interactive classes work best when learning SMET disciplines. Limiting class sizes from 15-20 promotes more one on one instruction, and allows important issues like building communication, critical thinking, and analytical skills into the curriculum. Fieldwork provides another excellent way to engage students, allowing them to collect the data they will later analyze in class.

Graduate students can be enlisted to tutor community college students and community college students can tutor middle school students (e.g., in after school math programs). These kinds of tutoring programs can help students potentially struggling with content. They also provide student tutors with opportunities to experience teaching as a potential career choice. It also helps if mentors and peer tutors are minority students so that students have role models with which to work. "2+2+2 programs" were also cited as an appropriate method to get potential teachers into the classroom and to provide bridges not only between the high school and community college, but the community college and four-year institution as well.

Interdisciplinary approaches can also be a valuable method to introduce students to science. In one model program cited, NSF provided support to make science more interdisciplinary. In this program, biology and mathematics were merged and team taught, focusing on real-world issues for the content of the course.

Finding qualified staff to teach was the primary challenge noted by the group. Funding can also be a major deterrent to introducing these kinds of approaches, but participants also noted that inquiry-based instruction also presents challenges

of its own when faculty (both resident and adjunct) are not adequately prepared to introduce newer pedagogical and learning styles in their courses. Clearly, more professional development opportunities are needed to improve faculty members' awareness of new, more appropriate pedagogies. More aggressive recruitment is also needed to identify more educators interested in science, mathematics, and technology teaching at all levels.

Providing professional development for SMET faculty

It is difficult for faculty to stay abreast of new developments in SMET fields, it was noted. Community college faculty members are particularly at risk of falling behind because they are isolated from state-of-the-art research conducted at universities. It is also extremely difficult to stay current on the latest advances in technology, and learn about new grant and other opportunities to enhance faculty professional development.

Many noted the value of providing cross-disciplinary and "cross-educational" professional development opportunities. For example, high school teachers and community college faculty could be provided with shared professional development opportunities, particularly in the application of technology. Community college and university faculty interaction through summer institutes was another model for improving SMET content knowledge, one which has the potential of sharing both ways (e.g., sharing content with community college faculty and more effective methods of teaching with university faculty).

It is important to ensure that the types of professional development programs meet the needs of the faculty participating in them. For example, the needs of new faculty can be significantly different than those of existing faculty and/or adjunct faculty, although all can benefit from professional development opportunities. To meet the needs of both requires new programs designed specifically for them, and release time and other incentives to ensure they are motivated to participate. A clearinghouse or other networking methods would also help to keep faculty aware of professional development opportunities.

On-going analysis and evaluation

In many of the group and breakout discussions, the need for student assessment and program evaluation was noted. Suggestions included multi-levels of evaluation, from developing methods to identify cohorts of students with specific needs to be addressed, to classroom assessments, to ongoing evaluation and analysis of new programs to determine their effectiveness. One effective method of communicating these assessments would be to establish a program at the community college level to report back to the feeder high schools on the success (or special academic needs of) transferring high school students. This kind of collaboration and communication could help ensure

that high schools are made aware of the strengths and weaknesses of their students, hopefully motivating the schools to take action. Another suggestion was to evaluate the impact of centralized and statewide testing on student success.

It was noted that students are often not well informed about the importance of high-stakes placement tests, and often are not prepared to do well on them. One obvious solution is to stress the importance to all students. Another suggestion was to change the format to include a variety of testing formats, not just multiple choice, to ensure that all students have an opportunity to demonstrate competence in a variety of forms.

The need for multiple forms of assessment for coursework was also noted, along with training for faculty to better understand new assessment methodologies. As one participant noted, faculty need to understand the importance of new techniques designed to assess learning, not just to hand out grades. If all faculty members (and their students) could reevaluate their expectations in this regard, all students would benefit.

Ensuring availability of appropriate instructional technology

It was agreed that critical thinking should be the focus of education and that technology should be the tool. It was also agreed that computers, calculators, and other instructional technology should be routinely available to all students in the classroom and in learning centers; these centers should be staffed so that students have an opportunity to learn how to use the various programs and other software. Students can often be effective tutors in these centers, and be provided with part-time jobs (e.g., through work-study programs) to support their own education. To ensure access, some colleges have leased laptops for student use; others have programs where students can rent calculators for class use. Participants also noted the importance of providing some sort of funding program to ensure that low-income students have access to computers.

Several challenges exist to ensuring the availability of technology. For example, there are infrastructure challenges, particularly in older buildings, which were not built to accommodate multiple computers. And, it was noted, technology quickly becomes antiquated and/or incompatible with newer equipment purchases. Another concern expressed by the breakout group was that administrations often make technology plans without faculty input so their needs and the needs of their students are not accommodated.

Clearly, planning and funding are critical if technology is a priority in education. On-going training and professional development are also critical if technology is to be integrated into the classroom and teaching labs. For students who often do not have access to computers at home, flexible lab hours are required.

Stage 3: Helping Hispanic students matriculate from the community college to four year schools or to the workforce– programs and services which enable Hispanic students to transfer to and succeed at employment or upper division institutions

Again, the general consensus was that cultural awareness programs for faculty at four-year institutions can help ensure that Hispanic students will succeed when they transfer. Making faculty and policy makers aware of the growing numbers of Hispanic students and their particular educational needs can also help lay the foundation for their success. In addition, the following best practices were discussed:

Developing strong transfer links to universities and employers

Community colleges need to form collaborative programs with both four-year institutions and with employers to ensure their students' success. Hands-on experience under professionals can help students expand their horizons, can provide them with networking experiences, and most importantly provide them with a measure of success. Establishing collaborative programs with industry and professional societies can also benefit student transitions. It was also noted that the private sector needs to be educated to look at alternative "assessments" of potential employees, not just a student's GPA, which is but one measure of a student's abilities.

Several challenges were noted during the course of this discussion, including students' own self-perception, educational advising and planning, out of state tuition costs, and the acceptance of community college educated students by the workforce. Hispanic students often move and/or transfer to a number of institutions throughout their education. To develop better linkages with potential employers and four-year institutions, it was recommended that students be required to participate in early orientation sessions at all stages of their education, that core courses be standardized to ensure students can transfer with less disruption to their education, and that a statewide articulated, computerized degree audit system be established to track students to ensure they are taking the necessary courses and are advised appropriately.

Developing instructional linkages with universities

As noted in the other group discussing the third stage, it is very critical for community colleges to develop linkages to universities. This is particularly important for Hispanic Serving Institutions to ensure the success of their students when transferring to universities. To this end, better tracking systems are needed, similar to those used by alumni associations. It's also important for community colleges and universities to maintain communication because, it was noted, SMET fields are not strictly occupational and therefore

education should be more closely aligned with current research and other breakthroughs in the field.

At the university level, the primary goal of this collaboration and communication should be to ensure alignment of the curriculum. Just like the transfer from high school to the community college, students need to experience a seamless transition from the two-year to the four-year institution. It was noted that this should go beyond articulation and into content and competencies if students are to succeed. Regular meetings between university and community college advisors and faculty can help in this regard. Meetings should take place at both kinds of campuses to help facilitate two-way communication. Students planning to pursue SMET studies should also be encouraged to form cohorts to help their transition to the four-year institution.

RECOMMENDATIONS FOR NSF

"Community colleges are on the front lines of minority education. Funding initiatives to meet the challenges [faced by] community colleges is absolutely essential." Michael Conway, Professor of Geology, Arizona Western College

The final task outlined for the symposium's participants was to provide a list of recommendations for the National Science Foundation. In particular, participants were asked what advice they had for NSF to help community colleges and other educational institutions better serve Hispanic students, their families, and their communities. The recommendations were far reaching, from providing more long-term federal funding for SMET programs at Hispanic Serving Institutions (HSIs), to advocating and supporting projects which promote the best practices outlined in this document. The following provides an overview of the recommendations and suggestions submitted by symposium participants.

Start with K-12 schools serving Hispanic students

From their very first discussions, it was clear that participants believed that the success or failure of Hispanic (and other) students in SMET disciplines is often determined in the very first years of their education, and that the National Science Foundation must therefore focus attention on all levels of education if NSF wants to ensure all students' success. As one participant noted, NSF should "provide funding for the poorest elementary and secondary schools so they can at least provide adequate computers, software, and laboratory equipment to students in math and science." Other specific recommendations include:

- encourage and support programs designed to improve elementary and middle and high school preparation in SMET classes;
- educate Hispanic students and others about the value of a college education by reaching out to middle schools enlisting successful role models as speakers;
- publish and promote (through posters, etc.) recommended middle school and high school courses to ensure adequate preparation in SMET disciplines; and
- support pre-college SMET programs on college campuses in the form of "summer colleges" or "afternoon college" and summer field studies for middle and high schools students.

Reach out to the Hispanic community

Many noted the importance of reaching out to families and community members to enlist their support of SMET programs at all levels. In particular one participant recommended that NSF should "develop best practices and methods that colleges can implement in reaching out to parents and community members to encourage and assist Hispanic students." Other recommendations included:

- provide more opportunities for the Hispanic community, parents, and students to learn about the value of pursuing a science and/or math education; and
- encourage the involvement of families in community college activities.

Support teacher preparation and professional development

Teachers at all levels need to be better prepared to teach science, technology, and mathematics content, and in-service teachers need access to more and better professional development opportunities (particularly those presented asynchronously or at times more convenient for in-service teachers). As one participant noted, "NSF should support academic content enhancement programs in mathematics and science for in-service elementary, middle and secondary school teachers. These programs [should] lead to Master of Science in mathematics and science teaching degrees." Other recommendations included:

- support programs designed to produce more K-14 science and mathematics teachers, especially Hispanic teachers and trained professionals interested in a second career in teaching;
- integrate proven pedagogies, best practices, and use of technology into existing teacher education programs;
- expand opportunities for in-service teachers to gain competency in their field (e.g., through release time, administrative support, and pay incentives); and
- strengthen and increase the number of teacher preparation and professional development opportunities for elementary and high school teachers serving Hispanic and other minority students.

Build bridges between institutions

Many participants expressed the belief that SMET education should be a seamless experience starting in kindergarten, following students through middle and high school, then into community college, and finally into four-year institutions and beyond. Many also noted the importance of encouraging communication between faculty and staff of all K-16 institutions. As one noted, "For purposes of curriculum articulation and improving transfer,

[NSF should] focus on clarifying and strengthening the working relationships between all segments of education: K-12, community colleges, and four-year institutions." Hispanic students also need programs designed to help them successfully transfer from one institution to the next, it was noted. Specific recommendations for NSF included:

- support SMET partnerships and other collaborative activities between K-12 and community colleges, particularly those that improve communication and clarify and strengthen relationships between high school and community college administrators, faculty, and students;
- encourage programs designed to increase the retention and success of community college students and foster their success when transferring to four-year institutions;
- support mentoring, tutoring, and professional development programs for community college and transferring students;
- support research opportunities and paid internships for community college students at four-year institutions; and
- promote increased collaboration between community colleges and universities to enhance matriculation of Hispanic students in SMET areas.

Encourage information sharing and disseminate what works

Community college faculty and administrators would benefit from more opportunities to interact with one another to develop SMET program ideas and to discuss what works. "Facilitate the development of math/science programs through symposiums [and] workshops (such as this one) focusing on minority students," one participant advised. Then the best practices developed at meetings and through NSF and other funded programs should be disseminated widely. Recommendations included:

- support symposia to facilitate dialogue and communication between SMET educators, administrators, and policy makers serving the Hispanic student population;
- bring together SMET faculty at all levels, from elementary school teachers to faculty at four-year institutions, to develop ideas on curriculum, resources, and technology to better serve Hispanic students;
- develop a clearinghouse and/or disseminate publications and reports on successful programs so that they can be replicated.

Provide more support for Hispanic students

Many noted the need for more financial and other support systems for Hispanic students. As one participant advised, it is important to support more SMET-related scholarships, internships, research assistantships, and work-study programs to enable students to have academic opportunities while re-

lieving them "from having to work at jobs unrelated to their major to fund their education." Other recommendations included:

- support pipeline programs which identify able minority students at an early age (no later than middle school) and prepare them for college studies in science and mathematics-related areas;
- support scholarships for Hispanic students starting at HSI institutions;
- create a clearinghouse of all SMET-related scholarships and internships available at community colleges and four year institutions;
- support student services for the development of early alert systems for the retention of students; and
- support programs for mentoring and training of community college students.

Support community college faculty

Faculty at community colleges can be real agents of change, but only if they have adequate time and resources. Many participants noted that community colleges need better standards for reasonable teaching loads and administrative responsibilities to enable faculty to be more effective as teachers and mentors to students, and faculty need more and better opportunities for professional development in SMET-related content, pedagogies, and assessments. Specific recommendations included:

- work towards a redefinition of community college faculty roles and workloads and appropriate funding so that faculty can develop curriculum, programs, and engage in outreach;
- support summer professional development programs in science content and methods at four-year research institutions for community college faculty at HSIs and other minority-serving institutions; and
- support community-college-based programs to develop assessment and evaluation of teaching methodologies and provide opportunities to learn these new approaches so that faculty can gauge student success in SMET disciplines.

Integrate technology education

Technology needs to be integrated into all educational activities starting at the primary school levels to ensure that there is no "digital divide" in education. Faculty at community colleges also need opportunities and support to integrate technology into their coursework and, thus, NSF should encourage "staff development activities to promote the successful infusion of technology into the curriculum and learning activities." Other recommendations included:

- promote access and technology training programs at community colleges that serve minority populations;
- encourage the integration of all possible technologies into the teaching of mathematics and science (but technology should not be used to replace learning core concepts); and
- provide professional development opportunities for community college faculty which introduce instructional methodologies (from low to high tech) in an interdisciplinary atmosphere.

Encourage outreach to industry

Participants expressed the importance of looking beyond campus to better understand the needs of students. They recommended community college leaders meet with industry and other SMET-related employers to ensure that students are developing the skills and critical thinking abilities employers need in the 21st century. Other recommendations include:

- support programs that include internships and other off-campus training opportunities for community college students; and
- host science, mathematics, and technology events for local employers to interact with community college faculty on campus and at local businesses.

Specifically target Hispanic Serving Institutions

All noted the importance of significantly increasing funding for Hispanic serving institutions so that they can implement the best practices discussed in this document and meet the growing needs of a growing student population. Many also discussed the importance of long-term funding so that SMET programs serving Hispanic students don't come and go. As one participant recommended, NSF needs to "institutionalize hard budget dollars to sustain grant funded programs." Other recommendations included:

- stabilize federal, state, and local funding for community colleges;
- provide adequate funding to accomplish the activities discussed at the meeting;
- when supporting projects, let the local level develop the guidelines and standards for achievement and ensure that qualified math and science professionals are in charge of SMET resources; and, more specifically
- NSF should request $20 million from Congress for new grant programs for HSI colleges.

APPENDIX 1
BEST PRACTICES: A REVIEW OF THE LITERATURE

SUMMARY OF BEST PRACTICES*
SMET and Hispanic Students
Three stages of student development

Stage 1: Helping Hispanic students matriculate from the high school to the community college – practices and programs which recruit and prepare high school students for success in SMET

- Developing strong links to elementary, middle school and feeder high schools
  - college awareness programs of two year & four year institutions
  - summer bridge programs in SMET
  - science fairs at high schools
  - on site college experience for students & teachers
  - social support for minority youth in high schools
  - basic skills education
  - work ethic
  - career exploration programs in SMET
- Involving the parents and family in the educational process
  - Mother Daughter Programs
  - orientation for parents to inform them about postsecondary education system (financial aid, academic support, advising students for college)
- Professional development programs for high school teachers in SMET
  - Encouraging teachers to belong to professional organizations in SMET
  - Summer institutes/workshops
  - Gen Ed courses in SMET offered to High school teachers as enrichment
- Ensuring availability of appropriate instructional technology
- Cultural Awareness Programs
- Involving policy makers in educational process
- Awareness of demographic change

Stage 2: Retaining Hispanic students in the community college – programs and services which help Hispanic youth to succeed in lower division courses

- Establishing student confidence by providing networks with peers, faculty and staff

- learning communities
- orientation for parents to inform them of education system and involve them
- peer support groups
- financial support

♦ Improving counseling and advising
- targeted counseling and advising for Hispanic students
- collaboration between counseling, advising and instructional faculty and staff

♦ Providing role models/mentors to interact with students
- diverse faculty
- mentors from college faculty and staff
- experienced students working with incoming students

♦ Insuring that students have the basic skills to succeed in college math and science courses
- tutoring services
- collaboration between Student Services, Developmental Ed and SMET departments and faculty
- "Recitation" programs

♦ Offering appropriate SMET pedagogies for student success
- small interactive classes
- applied methods in teaching
- diverse pedagogical styles
- service learning
- inquiry-based instruction
- build communication/critical thinking/analytical skills/leadership skills
- Interdisciplinary collaboration for building and implementing programs

♦ Providing professional development for SMET faculty
- summer institutes and workshops
- graduate courses and degree programs in SMET
- encouragement to join and participate in SMET professional associations

♦ Ongoing analysis and evaluation
- Assessment of student academic achievement in courses and programs
- Program evaluation

♦ Insuring availability of appropriate instructional technology

♦ Cultural Awareness Programs

♦ Involving policy makers in educational process

♦ Awareness of demographic change

Stage 3: Helping Hispanic students matriculate from the community college to four year schools or to the workforce– programs and services which enable Hispanic students to transfer to and succeed at employment or upper division institutions

- Developing strong transfer links to universities and employers
  - recruitment/outreach campaigns
    - summer bridge programs
    - orientation for parents
    - tracking methods for tracking community college students after transfer
    - job exploration programs in SMET occupational fields
- Developing instructional linkages with universities
  - transfer program awareness
  - research/intern opportunities
  - course and program articulation in SMET for Hispanic students
- Cultural Awareness Programs
- Involving policy makers in educational process
  - Awareness of demographic change

*Note: Bullets reflect "best practices" i.e. overarching principles or objectives guiding SMET programs, which are recognized in research literature as contributing to student success. Items listed under bullets are strategies or activities used to implement the best practice.

BEST PRACTICES

Selected Bibliography

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APPENDIX 2
BEST PRACTICES FROM PARTICIPATING CAMPUSES

ARIZONA WESTERN COLLEGE
Engaging Students in Geoscience

Arizona Western College is a two-year institution situated in rural southwestern Arizona. Our student population comprises about 62 % minorities, most of whom are first-generation, low income students of Hispanic origin who lack successful education role models. This absence of role models discourages minority youths from entertaining hopes of a career in science. In March 2001, we submitted a three-year proposal to NSF's "Opportunities for Educational Diversity in the Geosciences" (OEDG), to enhance our current offerings and to construct a three-phase geoscience education program to identify, recruit, and train talented Hispanic students in geoscience. This program will directly impact between 40 and 50 Yuma-area students, a number of whom, we believe, can be successfully vested in geoscience academic programs and subsequently careers in geoscience.

The linchpin of our program is a local research-quality seismic network comprising three broadband seismometers. Yuma is situated on the east perimeter of the seismically-active Salton Trough. Most area residents have felt earthquakes and students in our geoscience classes show an interest and enthusiasm in their origin and potential societal impact. Our plan is to recruit local minority high school students by engaging them in a topical science issue that impacts U.S. - Mexico border communities in Arizona and California. The proposed Arizona Western College (AWC) Seismic Observatory for geoscience education is a collaborative effort involving Yuma area science educators, the University of Arizona's Southern Arizona Seismic Observatory (SASO), and AWC's Geology and Physics faculty, among others.

Phase I of our three-phase program involves an annual 2.5 week summer seismic program where high school students and AWC geoscience majors explore the nature of earthquakes in the field and laboratory. Here, we use the experience and facilities of our colleagues at SASO, the Arizona Earthquake Information Center (AEIC), and the Centro Intercultural de Estudios de Desiertos y Oceanos, A.C., Mexico (CEDO) to give our students an excellent grounding in applied geoscience. Planned group-based field and laboratory experiences should provide the ambiance to stimulate learning and encourage intellectual growth resulting in improved academic performance. In Phase II, high school students will bridge up to one AWC's three geoscience programs. As part of the geoscience curriculum, students will work in the

seismic observatory and participate in regional field trips. Students will take an active role in geoscience outreach activities via student-produced geoscience radio programs at KAWC — local NPR affiliate -and with demonstrations to Yuma-area K-8 classrooms.

As part of Phase III, we hope to matriculate 50 % of student participants to geoscience programs at the University of Arizona or other institutions. The relationships fostered in Phase I and II will serve as an academic bridge connecting AWC students to faculty in the Geoscience Department at the University of Arizona. Our geoscience education program begins the task of creating a generation of minority geoscience professionals ready to assume a leadership role in the scientific, intellectual, and educational growth of the burgeoning southwest.

For more information, contact: Dr. Michael Conwayor, Div. Science and Math; Arizona Western College, Box 929, Yuma, AZ 85366; 520-317-6022; fax: 520-344-7730; or Dr. Stefan Dieter, Arizona Western College, Box 929, Yuma, AZ 85366; 520-344-7589; fax: 520-344-7730;

BOROUGH OF MANHATTAN COMMUNITY COLLEGE (BMCC)
E-distributed Teaching in Statistics

The Borough of Manhattan Community College (BMCC), City University of New York (CUNY) is a minority-serving, two-year urban commuter college within a large university system. The student body consists of a high minority and female population of approximately 15,000 students - 37.7% Black, 9.7% White, 30.0% Hispanic, 12.1% Asian, 0.2% Native American and 10.1% other; 36.4% male and 63.6% female (BMCC Fact Book, 1999-2000). This population is diverse in terms of academic major, ethnicity, gender, age, disabilities, work and life experiences, full-time/part-time status and college level.

This project involves the use of Blackboard Online Course Management Software, Excel or other statistical software package, and Power-point, to teach two introductory statistics courses. The student population for these courses (offered as a mathematics requirement or elective course for many programs in this college) is diverse in terms of academic major, ethnicity, gender, age, disabilities, work and life experiences, technological exposure, matriculated status, and college level. Blackboard is used as an instructional delivery system, Excel or other statistical software package to conduct statistical analysis, and Power-point to give presentations.

The ultimate goals of this project are to help students cultivate the skills and habits of mind necessary for informed citizenship, leadership, and life-long learning, and to prepare them for the challenges of the workforce in the age of

information technology, and a period where quantitative literacy is an essential skill. Specific objectives being accomplished with the use of the information technology learning environment are the creation of learning communities in which members are adept at thinking statistically, conducting statistical research, and using the World Wide Web as a research tool, empowered in the art of reflective practice, skilled in the use of threaded discussion, email, virtual chat, and web pages as a networking forum, and skilled in presenting statistical research using power-point and other modes of presentations. Since this is the only statistics course these students take throughout their college program, exposure to these information technologies within the course is a powerful learning experience, which falls within the recommendations of the American Mathematical Association for Two-Year Colleges Standards (1995).

Seven sections of Math 50, Introduction to Statistics, and Math 209, Statistics, e-distributed courses have run since commencement of the project in Spring 2000. Approximately 210 students have been served in a hybrid manner, with in-class meetings for approximately 70% of the officially designated class meeting times and the remaining 30% of the officially designated class meeting times being devoted to virtual space meetings. The courses are still in the development phase, with enhancements being made on the basis of formative and summative field-test assessment by students registered for these courses, by the instructor (project director) who is teaching these courses, and input from participants involved in the programs identified as funding sources. The Introduction to Statistics course is also being developed as a fully asynchronous on-line course to run for the first time in Fall 2001.

For more information, contact Dr. Nkechi Agwu, Borough of Manhattan Community College; 199 Chambers St., New York, NY 10007; 212-346-8556; fax: 212-346-8550; nagwu@bmcc.cuny.edu

CERRITOS COLLEGE

Our goal is to increase the number of transferring students from Cerritos College, who are majoring in areas of chemistry and biology. Hispanic students comprise 44% of math and science students at Cerritos. The college serves 1,021 Hispanic students.

Biology – Chemistry Student Meeting #1

During the first half of each fall semester we send a letter to each student who is a designated major in the areas of chemistry and biology inviting them to a meeting on campus to discuss their academic preparation to transfer. We also enlist our colleagues to invite undeclared students who may want to major in chemistry or biology. At this meeting we stress MATH

preparation, pre-requisite planning and course scheduling. We present several "preferred" course sequences, which are designed to accommodate course offering times and pre-requisite fulfillment. We also explain what is required to transfer to University of California and California State University institutions. We strongly suggest that students seek out faculty in our departments for advising (optional and unpaid.) Lastly we explain that students wishing to gain admittance to impacted programs need to show "extra effort." We explain that this extra effort may be their employment, their volunteer work, extra courses taken, or it may include undergraduate research. Lastly we introduce undergraduate research programs that our students may apply for. The principal undergraduate research program for our underrepresented students (primarily Hispanic) is our Bridges to the Baccalaureate grant with California State University, Long Beach.

Biology – Chemistry Student Meeting #2
Later in the fall semester, prior to the state application deadline, we have a second meeting. This meeting is aimed at students who are applying to transfer the following fall semester. Our principal goal here is to remind students that what courses they indicate that they will take, must be taken. We stress that universities admit them contingent upon their completing these obligations, and that work obligations, social obligations and even some family obligations may need to be altered so that they complete their courses of study.

Bridges to the Baccalaureate
Cerritos is a partner with California State University, Long Beach and Long Beach City College in a Bridges to the Baccalaureate grant, a NIH grant. We will soon be entering into our seventh summer of providing our students paid research opportunities. Cerritos has had 41 students participate thus far. Of those, 28 have transferred on to four-year institutions in science.

Science Mentors
Students who have transferred to 4 year institutions and professional schools volunteer to return to Cerritos as our science mentors. Our science mentors come back to give presentations to our current students, have a question and answer time, will talk to students on an individual basis and invite them on to their respective universities.

Science Seminar
Our faculty has developed a 1.0 unit Science Seminar course that meets every week. The course is run much like a traditional science seminar course at universities where professors come in to present their current work; however, we also invite our past students who are currently performing research at the university level.

For more information, contact: Cheryl Chimazu or John Boyle, Cerritos College 11110 Alondra Blvd., Norwalk, CA 90650; 526-860-2451;fax:562-467-5078;cshimazu@cerritos.edu; jboyle@cerritos.edu

HOUSTON COMMUNITY COLLEGE
NASA/HCC Science Challenge Program

The Houston Community College System (HCCS) has designed the NASA/ HCC Science Challenge Program to increase the number of Hispanics and other underrepresented students pursing careers in SMET (science, mathematics, engineering, and technology) fields. The faculty of HCCS planed a program that focused on academic enrichment and support systems that will address the needs of underrepresented students and enable them to compete successfully at senior college and university.

The objectives of the program are:

Objective 1. Recruit and retain at least 100 underrepresented students into an Associate of Science Program of curriculum enrichment and support to assure their successful transfer to a Baccalaureate degree program.

Objective2. Develop a coordinated learning-centered science curriculum that addresses the needs of underrepresented students and satisfies articulation requirements of four-year colleges and universities.

Objective 3. Provide four professional development workshops to train mathematics and science faculty in teaching methodologies that address the learning needs of underrepresented students.

Since the inception of the program approximately eighty five students have participated in the NASA/HCC Science Challenge Program. The students have made field trips to NASA-Johnson Space Center and the University of Houston-Clear Lake. Four of the biology and physics students participated in the Texas Community Colleague Reduced Gravity Student Flight Program, to fly aboard the Johnson Space Center's KC-135A reduced gravity aircraft. The project gave our students the opportunity to propose, design, fabricate, fly and assess a reduced-gravity experiment. The experience included a scientific scholarship and hands-on text operations along with education and outreach activities.

HCC faculty has worked with area universities to ensure that our curriculum satisfies articulation requirements. We have worked with transfer to the University of Houston and the University of Houston –Downtown. The Univer-

sity of Houston was targeted for biochemical/biophysical sciences, chemistry, engineering, geology/geophysical sciences and physics. The University of Houston-Downtown was targeted for computer sciences and mathematical analysis sciences. In the first year of NHSCP, 12 of our participants transferred successfully to the University of Houston system. The university partners have been highly support by providing our students with a variety of academic enhancements through their own special programs, such as counseling, academic and financial planning as well as transfer procedures, programs and career opportunities.

In addition, the NHSCP have provided the students with a CD-ROM tutorial library, with the following tutorials purchased for the program: The Princeton Review (Math Review, Algebra I and II, Geometry, Trigonometry, Calculus); The Ultimate Mathematics (Pre-Algebra, Algebra I and II Geometry, Trigonometry, Pre-Calculus, Calculus, Statistics. Furthermore, the students have received tutoring in respective colleges and meet on a weekly basis. More than 50 students have been given a packet of financial aid and scholarship information. Also selected twenty seven students received stipend's (based on interest in the program, attendance, activities, academic progress and commitment to earning a baccalaureate degree. Several speakers have attended our monthly meetings, such as from Baylor College of Medicine, University of Houston, Clear Lake and University of Houston Downtown and made presentations to 30 students.

In terms of faculty professional development, several workshops were conducted. The workshops included a presentation by the Dana Center at the University of Austin, for guidance on establishing the Challenge Enrichment Program based on the Uri Treisman model. The lectures and workshops for faculty and students were well attended. The lectures were combined with our student lectures with faculty development by inviting participants to all of these special events. The lectures expose students to a higher level of academic learning, enable them to interact with the faculty and role models, and stimulate the interest in SMET teaching careers

For more information contact: Luis Treviño, Houston Community College 1300 Holman, PO Box 667517, Houston, TX 77266-7517; 713-718-6123; fax: 713-718-6128; trevino_l@hccs.cc.tx.us

MESA TECHNICAL COLLEGE

Mesa Technical College is a two-year community college in eastern New Mexico with about 450 students, serving the needs of the local region. Our student body is about 40% Hispanic in a diverse community. Mesa Technical College offers both the liberal arts Associative of Arts degree as well as applied and technical degrees. It is home to the Mesalands Dinosaur Mu-

seum, and it is one of the few Community Colleges to support such a museum and its associated research. Many of the dinosaur pieces are replicated in the College's Bronze Foundry, which is a fully contained art and casting laboratory.

I am the Mathematics and Physical Sciences lead instructor at Mesa Technical College. A typical student seeking an Associative of Arts degree needs College Algebra to graduate and I teach a sequence of Algebra courses with about 20 students per class. I also teach the Physical Science electives that students need which include Physics, Chemistry, and Astronomy. These science classes are held in a modern laboratory using experiments with computer data acquisition and analysis, along with standard physical equipment. As the lead Chemistry instructor, last summer I was successful in obtaining funding from Project Emerald here in New Mexico to take a student and myself to Sandia National Laboratories for a research project. Project Emerald is a NSF – funded project to help support research at Two-Year Colleges in New Mexico. Under their auspices, the student and myself studied Carbon Nanotube formation via growth by Chemical Vapor Deposition at Sandia National Laboratories.

I am also the Faculty Advisor to Phi Theta Kappa, the Honor Society of the Two-Year College. This organization recognizes students with above average grades and scholastic ability. This year two of our students were recognized as PTK USA-Today Academic Scholars and were rewarded with scholarships. Our chapter has raised over $1000 in the last year, which has funded trips to the Regional and International Conferences. This coming year, we hope to be recognized as a three-star chapter as a result of our scholarship and community outreach activities.

For more information, contact: Dr. Forrest Kaatz, Mesa Technical College 911 S. 10th St., Tucumcari, NM 88401; 505-461-4413; fax: 505-461-1901; forrestk@mesatc.cc.nm.us

PHOENIX COLLEGE
Arizona Teacher Excellence Coalition (AZTEC)

The AZTEC grant project is a statewide partnership between the three Arizona Regents' Universities, targeted community colleges, and partner school districts. The project is designed to: (1) Increase the number and quality of initial recruits to teacher education programs; (2) Enhance the quality of mathematics and science content courses and clinical experiences for future teachers; (3) Increase the percentage of new mathematics and science teachers prepared by state institutions and concomitantly reduce the shortage of qualified mathematics and science teachers in three targeted Enterprise Communities (EC) in the state; (4) Demonstrate higher mathematics and science achievement for Arizona students due to the impact of AZTEC; (5) Improve

the quality of a graduate's performance as new teachers; (6) Establish sustainability of the partnership through institutional agreements and shared scope of work. The full grant proposal may be accessed at the web site: http://www.eas.asu.edu/~cresmet/DoE-Partner/.

Phoenix College is located within one of the three targeted EC areas experiencing a shortage of qualified teachers. Recognizing that many prospective teachers receive their only college-level mathematics courses at the community college, PC has undertaken the project of reforming the mathematics courses required for future elementary educators. The goal of this reformation process is the alignment of our curriculum and instruction with the best understanding of how students learn and retain mathematical concepts ("best practices"). To accomplish this goal, instructional design is focused on a hands-on constructivist approach. This approach results in more actively engaged and self-directed students obtaining a deeper understanding of powerful mathematical concepts. Activities utilizing mathematical manipulatives have been written, implemented, and refined by a team of mathematics faculty. The mathematical manipulatives used for these experiential activities have been acquired by the department and are used consistently within the classroom.

Phoenix College students are engaged in a service learning project with Osborn Middle School's Math Club. Additionally, the PC Future Teachers' Club sponsors joint activities and provides support to the Future Teachers' Club at Carl Hayden High School. The current curriculum project will be expanded to develop a second mathematics course for the pre-service elementary educator. This course will focus on the incorporation of appropriate computational technologies.

The mathematics department at Phoenix College services approximately 3000 students in subject content ranging from arithmetic to differential equations. We provide a variety of instructional methods to accommodate the many learning styles of our students. For many of our students English is a second language, and so we offer an ESL math class which addresses the need to learn mathematics concepts as well as the language of mathematics in English. The College has a Title V Program aimed at increasing the number of students persisting through the various mathematics courses, becoming technologically literate, and graduating.

For more information, contact: Deborah Ermoian, Professor of Mathematics; Department Mathematics, Phoenix College; 1202 W. Thomas Road, Phoenix, Arizona 85013; 602-285-7390; fax: 602-285-7700
Cleopatria.martinez@pcmail.maricopa.edu

PIMA COMMUNITY COLLEGE
Proyecto Access-Tucson Prep

PROYECTO ACCESS-TUCSON PREP seeks to increase the number of underrepresented minorities, especially Hispanics and females, in the fields of math and science by developing critical thinking and problem solving skills, fostering self-sufficiency, and exposing the students to higher levels of mathematics at a younger age.

Tucson PREP is a seven-week enrichment program that targets high achieving middle school and high school students from socially and economically disadvantaged families. It is funded by NASA through HACU (Hispanic Colleges and Universities) and is one of nine sites in the nation replicating the TexPREP model. Our program lasts for seven weeks and includes the following curriculum: First year participants study Logic, Computer Science, Introduction to Engineering, and Topics in Problem Solving, which range from Pre-Algebra to Discrete Mathematics and Trigonometry. The curriculum of the returning second and third year students includes Probability and Statistics, Physics, Pre-Calculus, Introduction to Computer Programming and Topics in Problem Solving.

This program is one of the few enrichment programs available to our students at no cost. It exposes the new participants to levels of mathematics that they will not encounter until their senior year in high school or perhaps college. It emphasizes critical thinking and problem solving.

In addition, there are field trips and presentations given by guest speakers from the professional community. Some of our field trips have included visits to: University of Arizona, IBM, Biosphere, Desert Museum, Kitt Peak Observatory and Pima Air Museum.

This past summer PROYECTO ACCESS-TUCSON PREP had served 87 students from 31 different schools in the Tucson area. The minority representation was 80.5% with Hispanics constituting 46% of the total population. We were also pleased with the ratio of females to males being 56% to 44% respectively.

1999-Best Education Practices Award, Received from: Arizona Commission for Post Secondary Education.

For more information, contact: Ana Mantilla, Pima Community College 1255 N. Stone, Tucson, AZ 85709-3030; 520-206-7331; fax: 520-206-7063 amantilla@pimacc.pima.edu

SACRAMENTO CITY COLLEGE

As division dean, I facilitate multiple programs aimed at providing support to underrepresented students in the math, science, and engineering disciplines. The goal of all the programs is to assist students majoring in the aforementioned disciplines to succeed academically and professionally develop, so that they are competitive and able to transfer to four-year institutions in pursuit of the bachelor's degree and more.

The MESA (Math, Engineering & Science Achievement) program serves up to 125 students majoring in transferable programs in math, engineering, science, computer science and allied health. Students are provided with tutorial services in the major courses, focused counseling services, professional development opportunities, academic excellence workshops, a math boot camp, a three week-enrichment program, a statewide, leadership retreat and opportunities to compete for research opportunities nationally.

Our students are also eligible to compete for institutional, industry-sponsored, and National Science Foundation scholarships. The academic excellence workshops are sponsored by the California Alliance for Minority Participation in the Sciences, which is funded by the National Science Foundation through the University of California, Davis. The Lois Stokes Alliance for Minority Participation program is also funded by the National Science Foundation, through California State University, Sacramento. Our students can compete for summer workshop opportunities through this program as well.

The MESA program has been in place for 8 years and our students have participated in a diverse set of research experiences with renowned centers including NASA, Department of Energy, California Institute of Technology, and UC & CSU based programs. Over 100 students have transferred to outstanding schools including UC Berkeley, UCLA, UC San Diego and Cornell.

We are funded through institutional support and the California Community Colleges Chancellor's Office. We are also supported through the National Science Foundation's Computer Science, Engineering and Mathematics Scholarship (CSEMS) program, subcontracts with California State University, Sacramento and the University of California, Davis and local industry.

For more information, contact: Alice Murillo, Sacramento City College 3835 Freeport Blvd., Sacramento, CA 95822; 916-558-2201; fax: 916-558-2656; murilla@scc.losrios.cc.ca.us

SAN DIEGO CITY COLLEGE
Mesa Program

Math, engineering and science achievement. The words are noble and easily spoken. The deed is a more difficult challenge. However, at San Diego City College the future is looking brighter for disadvantaged students in math-based transfer majors. Math, Engineering and Science Achievement (MESA) is the name and mission of City's new student support program. The program goal is to significantly increase the number of these disadvantaged students who transfer to and obtain Bachelors Degrees from four-year universities.

Established in Fall 2000, the City College MESA program is a proactive model for student achievement. The MESA model is based on a rigorous academic program that uses various components to support students majoring in math, engineering and science. The program components help build an academically based peer community to provide mutual student support and motivation. This community of learners is what sets MESA apart from other programs. The main components of the MESA program include:

- Student Study Center
- Academic Excellence Workshops
- An orientation course
- Assistance in the transfer process
- Career advising
- Links with student and professional organizations
- Professional development workshops
- Industry Advisory Board

Although MESA is relatively new at City College, MESA is an exemplary statewide model with a 30-year history of success. MESA Statewide works with over 20,000 students throughout California from elementary to university levels, including 33 MESA centers located on community college campuses throughout the state.

The success rate of MESA students is outstanding. Within the community colleges that sponsor MESA programs, MESA students comprise 35% of all underrepresented student transfers to the University of California and 89% of MESA transfer students go on to major in math, science or engineering at four-year universities. This track record of academic excellence helped MESA Statewide to earn the prestigious Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring in Fall 2000. The award, bestowed on only ten institutions and ten individuals across the country, was created by President Clinton in 1996 and is granted by the National Science Foundation to honor those who serve as national models for mentoring students from underrepresented groups in math-based fields.

City College is honored to be a partner in an exemplary statewide initiative. Moreover, the City College MESA program is a regional member of the San Diego MESA Alliance (SDMA). The SDMA boasts a membership of seven MESA centers, including San Diego Unified, Cuyamaca College, Southwestern College, SDSU, UCSD and the Campo Indian Education Center. SDMA's mission is to enhance the pipeline for MESA students in San Diego County. The Alliance goals are to establish best practices, plan strategic partnerships, enhance coordination of services and coordinate development of core curriculum for MESA programs.

Transfer is a priority for the San Diego Community College District and City College, especially in math-based majors. The MESA program will help to increase the number of City College transfers. In its first year of operation the City College MESA program has already served over 160 students. Dean Armando Abiña is the MESA program administrator and Rafael Alvarez is the program director.

For more information, contact: Raphael Alvarez, San Diego City College 1313 12th Ave., San Diego, CA 92101; 619-388-3156; fax: 619-388-3915 ralvarez@sdccd.net

SOUTH TEXAS COMMUNITY COLLEGE

During the spring, summer, fall of 2000, and Spring 2001, the following activities have been completed or are still in progress at STCC:

- Several STCC SMET students have been awarded grant money to tutor other math, statistics, and physics students. Seven students have finished their associate degrees at STCC and have transferred to other institutions to finish their undergraduate degrees, some are still working on their associate degrees. Two students have received internships to visit and interact with experts at national labs.

- Workshops were held to train and tutor students on the use of the math software, Maple 6. The training helped the students visualize and understand difficult math concepts in pre-calculus, calculus, linear algebra, and differential equations, and will serve them well in future math-related courses. The workshops also included a short seminar on the use of technology in math. More workshops seminars are planned for this year.

- Under supervision of Math and Science Faculties, several students from the Math Club have visited the NASA Space Center in Houston and other four-year degree campuses. Plans are under way for more math and science educational trips.

- Major progress has been made to create the math tutor Web Page.

Similar activities will continue in the second and third year of the grant.

For more information, contact: Dr. M. Fathelden; Mathematics Department, STCC P.O. Box 9701 McAllen, Texas 78502-9701; (956) 928-3408; Fax: (956) 668-6413; mfathel@stcc.cc.tx.us

SOUTHWESTERN COLLEGE
Biotechnology Program

Southwestern College (SWC) is a Hispanic-serving community college. SWC is the only community college that currently serves the need of the southern San Diego County for biotechnology training. The Biotechnology Program is designed to serve as a pipeline that will take students from high school to higher education to employment. Currently the Biotechnology Program offers three tracks, a vocational certificate, an associate degree and a transfer track. The transfer track of the SWC Biotechnology Program distinguishes it from most vocational training programs now available at the community college level. SWC is actively involved in outreach to our feeder high schools, offering exposure to students and faculty alike. The program serves 10-20 students per year

Program Goals:

1) Increased exposure of south San Diego County high school students to biotechnology.
2) Increased numbers of high school faculty trained in biotechnology.
3) Increased career options for community college students.
4) Increased opportunities for pursuing baccalaureate and post-graduate education.
5) Increased numbers of skilled employees for local industry.
6) Increased opportunities for economic development for individuals and industry.

Best Practices:

1) Exposure to current laboratory procedures and equipment, for example, DNA gel electrophoresis, protein gels, PCR and ELISA techniques.
2) Training in scientific oral presentations
3) Training in legal scientific documentation of laboratory procedure and experimental records.
4) Providing guidelines and mentoring for developing educational plans.
5) Training in interviewing skills through mock interviews.
6) Providing guest lecturers.

For more information, contact: Dr. Nouna Bakhiet, Southwestern College 900 Otah Lakes Rd., Chula Vista, CA 91910; 619-421-6700; fax: 619-482-6503; nbakhiet@swc.cc.ca.us

WEST HILLS COMMUNITY COLLEGE
MESA Program

Mathematics, Engineering, Science Achievement (MESA) Program is an academic preparation program that assists California's educationally disadvantaged students to succeed in math and science and attain four year degrees in math and science fields.

The MESA California Community College Program (MESA CCCP), which West Hills Community College District belongs to, serves community college students and assists them to successfully transfer to four year institutions in math or science majors.

For more information contact: Eluterio Escamilla, West Hills Community College 300 Cherry Lane, Coalinga, CA 93210; 1-800-266-1114x3332; fax: 559-935-3788; escamiel@whccd.cc.ca.us

APPENDIX 3
LAYING THE FOUNDATION

Welcoming Remarks
Congressman Ed Pastor, U.S. House of Representatives

In his welcome to the symposium, Congressman Pastor noted that he had been fortunate to have studied chemistry and biology which provided a great foundation for the rest of his academic career and, later, his career in politics. But many students, he pointed out, do not have the opportunity to pursue science and mathematics. This is particularly true for minority students who too often aren't provided with the academic support they need to adequately learn the subjects and/or they are in classrooms where teachers can't teach science and mathematics because they, too, have been inadequately prepared.

What will happen to these students if they can't understand simple scientific concepts or perform simple math, he asked the group. As a nation, we have to provide all students and their teachers with the opportunities and support they need to excel, or our country faces an ever-diminishing pool of qualified scientists and engineers. But these kinds of programs need to be viewed as national priorities, he said, if the programs are to be adequately funded at the level necessary for them to succeed. We must take care of our children, Congressman Pastor urged the group, and all symposium participants must do their part to inform their Congressmen and Senators about how critical education and healthcare programs are to the future of our nation.

The focus of the symposium, therefore, is most timely and important, he said. We need to look at the full range of best practices to ensure that, beginning at the elementary school level, all students have the support they need to excel in science, mathematics, and technology. We also need to advocate for change and inform the nation about the resources our schools and students need to be successful. Ultimately, our goal should always be to ensure that all students have the opportunities they deserve, particularly in science and mathematics.

Demographics: Separating Myth from Reality
Dr. Baltazar Arispe Y Acevedo, Jr.

The 1970's were referred to by the media as "the decade of the Hispanics." At that time, the Hispanic population in the U.S. was approximately 15 million. In the year 2000, the Hispanic population was officially documented to be in excess of 35 million (and that number could easily be 10 percent under counted). Perhaps we should refer to this as "the century of the Hispanics."

Demographic information now available from the 2000 census and other sources reveal that the U.S. population is changing dramatically. These changes pose significant challenges but also create great opportunities for educators, politicians, and others concerned with public policy. If we rise to the challenge now, we can significantly affect educational outcomes and have a positive effect on education and the long-term economic stability of the country. Ignore these data, and we do so at our own peril.

From Minorities to Majorities

The official 2000 census reports that the U.S. has 35,305,818 Hispanic or Latino residents, or 12.5 percent of the U.S. population (FIG. 1). By the year 2025, the Census Bureau has projected the U.S. will have close to 60 million Hispanic residents. California alone is projected to have 21 million Hispanic residents by 2025; Texas is projected to have 10 million; and Arizona will have in excess of 2 million Hispanic residents (FIG. 2; U.S. Census Bureau, 1995).

Figure 1

Subject	Race Alone (min. pop.)		Race in Combo. Only		Race along or in Combo. (max. pop.)	
	Number	% of Total Pop.	Number	% of Total Pop.	Number	% of Total Pop.
TOTAL POP.	281,421,906	100	281,421,906	100	281,421,906	100
Hispanic or Latino	**35,305,818**	**12.5**	35,305,818	12.5	35,305,818	12.5
Not Hispanic or Latino	246,116,088	87.5	246,116,088	87.5	246,116,088	87.5
# of Race Responses	241,513,942	85.8	9,590,697	3.4	251,104,639	89.2
White	194,552,774	69.1	3,625,126	1.3	198,177,900	70.4
Black/African American	33,947,837	12.1	1,435,916	.5	35,383,751	12.6
Amer. Indian or Alaska Native	2,068,883	.7	1,375,817	.5	3,444,700	1.2
Asian	10,123,169	3.6	1,456,325	.5	11,579,494	4.1
Native Hawaiian/ Other Pacific Islander	353,509	.1	394,640	.1	748,149	.3
Some other race	467,770	.2	1,302,875	.5	1,770,645	.6

Source: US Census Bureau, April 2001

Figure 2: Top Ten States US Hispanic Population Growth Projections

State	July 1995	July 2000	July 2005	July 2015	July 2025
California	9,206,000	10,647,000	12,268,000	16,411,000	21,232,000
Texas	5,173,000	5,875,000	6,624,000	8,294,000	10,230,000
New York	2,541,000	2,805,000	3,071,000	3,664,000	4,309,000
Florida	1,955,000	2,390,000	2,845,000	3,828,000	4,944,000
Illinois	1,090,000	1,267,000	1,450,000	1,840,000	2,275,000
New Jersey	896,000	1,044,000	1,196,000	1,513,000	1,861,000
Arizona	868,000	1,071,000	1,269,000	1,641,000	2,065,000
New Mex.	657,000	736,000	821,000	1,011,000	1,241,000
Colorado	507,000	594,000	682,000	859,000	1,067,000
Mass.	355,000	437,000	524,000	719,000	934,000

This projected growth will result in this "minority" population potentially becoming the majority in some of these states. Some counties in Arizona, for example, have seen 100 to over 200 percent growth in Hispanic population from 1990 to 2000. In Texas, it is projected that by the year 2030, Hispanics will make up 46 percent of the population (up from 25% in 1990), with Anglos composing only 36 percent (down from 61 percent in 1990) (Texas State Data Center, 2000).

It's important to note that while the current U.S. population as a whole is aging, with the median age at 35.7 years old, the current Hispanic population is much younger, with a median age of 26.9. In other words, the Hispanic population is in its prime for marrying and starting new families. So nationwide, the school age population of Hispanic residents age 5 – 24, is projected to increase 222 percent from 1995 to 2050, while the school age population of White, non-Hispanic students will decrease by 6.6% over that same period (FIG 3; U.S. Department of Commerce, Bureau of the Census, 1998). The students we see in our schools K-16 will be less and less White, and increasingly Hispanic.

Figure 3: Projected Growth in School-Age Population, 1995-2050
School Age Population (000), Ages 5-24

Population Group	1995	2000	2010	2030	2050	% Growth
Hispanic	9,706	11,509	14,167	22,111	31,300	220%
White, Non-Hispanic	50,314	51,079	50,173	47,961	46,806	-6.65
Total US Population	74,077	78,053	82,635	92,203	105,346	42%

Source: US Dept. of Commerce, Bureau of the Census, 1998

Educational Achievements

Unfortunately, while it is expected that the number of Hispanic students will continue to rise, the educational achievements of Hispanic and non-Hispanic students are already not keeping pace. While 33.9 percent of all White students complete high school, only 26.8 percent of all Hispanic students graduate. The disparity is even greater at the post-secondary level. While 24.8 percent of all Whites age of 25 and over attend some college, only 17.6 percent of Hispanics attend some college. And while 25 percent of all Whites age 25 or over complete a BA/BS degree (or more), only 11 percent of Hispanics do so (FIG. 4; U.S. Department of Commerce, Bureau of the Census, 1998).

Figure 4: Educational Attainment in 1998 for Population Age 25 and Over (Percent Completed)

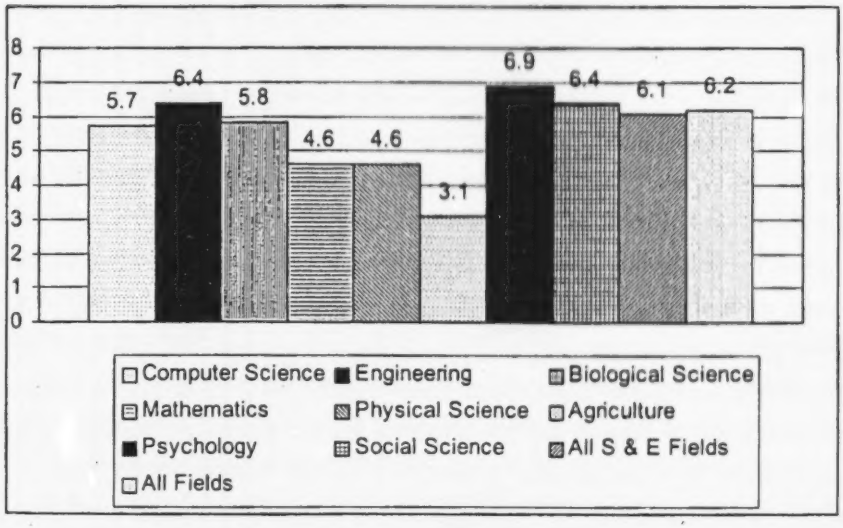
Population Group	None - 4th Grade	5th - 8th Grade	9th - 12th Grade (no dip.)	High School Graduate	Some College or Assoc. Degree	BA/BS or More
Hispanic	9.3	19.3	15.9	26.8	17.6	11.0
Men	9.3	18.8	16.2	27.2	17.4	11.1
Women	9.2	25.8	15.7	26.4	17.9	10.9
White	1.5	5.7	9.0	33.9	24.8	25.0
Men	1.6	5.7	9.0	32.0	24.1	27.3
Women	1.5	5.7	9.0	36.6	25.4	22.8

Source: US Dept. of Commerce, Bureau of the Census, 1998

In fact, in the United States in 1993, the drop out rate was 28 percent for Hispanic 16-24 year olds and 40 percent of Hispanic dropouts did not finish the eighth grade. In Texas the numbers were even more disturbing: 49 percent of Hispanic ninth graders (vs. 31 percent of white ninth graders) did not reach the 12th grade, and the number of dropouts increased from 86,000 in 1986 to 151,000 in 1998 (Intercultural Development Research Association, 2000).

Hispanics are also under-represented when it comes to college degrees. For example, of all the Associate degrees awarded, only 6 percent have been given to Hispanics; of all the Bachelors degrees, only 4 percent have gone to Hispanics; of all the Masters degrees, only 3 percent have gone to Hispanics; and of all the Doctoral degrees, only 2 percent have been awarded to Hispanics students (IDRA, 2000). According to data from the National Science Foundation, of all Science and Engineering BA's awarded in 1996, only 6.1 percent were awarded to Hispanics (FIG 5).

Figure 5: Hispanics as Percent of Total S&E Baccalaureates (US Citizens and Permanent Residents) 1996



For those of you committed to expanding opportunities and the success rates of those underrepresented in science, mathematics, engineering, and technology, it is clear that much more needs to be done when addressing the recruitment, retention, and graduation of Hispanic students at all educational levels.

Challenges and Opportunities

As educators and those who can affect public policy, we all need to embrace the challenges inherent in these numbers. As a country, we cannot afford to ignore data that indicate that a large number of students are currently not being served by our educational system. We certainly cannot ignore the fact that the number of those underserved students is growing. Nor can we afford to look to a future where a large percentage of our population is under educated, particularly in the fields of science, mathematics, engineering and technology.

But there is a bright light in this discussion and that's the community colleges represented at this meeting. Community colleges have a unique opportunity to meet the educational needs of these rising numbers of students, and to set standards for the high achievement and success of Hispanic students. But there is a challenge inherent in this opportunity. All the best practices in the world are destined to run into the wall of these demographic data. The nation is looking to a small number of Hispanic-serving institutions to meet the growing needs of a large group of students. I urge you and your colleagues to rise to the challenge. Don't let our educational system turn into one where there is a majority in participation, but a minority in educational outcomes.

Access and Beyond: Community Colleges Bridging the Digital Divide
Dr. Alfredo G. de los Santos, Jr. and Dr. Gerardo E. de los Santos

From cell phones, to palm-size computers, to distance learning, to online banking, advances in information technology continue to astound us. Almost every day we learn of new, exciting technological advancements, almost all of which are marked by unparalleled access to information, or communication capacities that look and feel like science fiction, or breakthroughs in hardware and software that are driving dramatic change at a pace that's almost impossible to keep up with. Yet, the wonders of these new technologies and the exponential rate of change that they bring have created a Digital Divide in which economically challenged and minority populations struggle with a significant lack of access to these newly emerging technologies.

During this presentation, we're going to discuss Dramatic Change, the Digital Divide, Digging In, and Dedication to Education. We're going to share some examples of how dramatic changes in technology are influencing the

way we communicate, the way we go about our core business of learning in education, and the way the Net Generation is changing the very foundations of technology and expectation.

Dramatic Change

If you think about the dramatic changes that advances in technology have brought about in just the past 10 years, it'll make your head spin. For example:

- Internet traffic doubles every 100 days.
  According to the consulting firm of Deloit and Touche, the only thing that grows faster than Internet traffic is bacteria!

- The average surfer spends 8.8 hours per week on 9 websites, and what we are learning is that the average surfer is spending more time on the Web per week, yet they are visiting fewer sites, which tells us that the Web is getting increasing sophisticated regarding strong e-commerce connections to customers.

- A third of "wired" adults shop online.

- Almost one-half of Americans send an e-mail each day! In a very short period of time, we're experiencing significant change in the way we communicate using technology!

- 36 million people obtain one weekly news story online.

We're also experiencing dramatic change in education. Peter Drucker, the renowned management guru and author of *Management Challenges for the 21st Century,* says that "In the next 50 years, schools and universities will change more and more drastically than they have since they assumed their present form more than 300 years ago when they organized themselves around the printed book." According to K.C. Green's 1999 Campus Computing Survey, approximately 60% of college courses use e-mail; more than 2 of 5 college courses use Web resources; approximately 50-80% of students and faculty access the Internet daily; and almost one half of college courses have a Web page.

But one thing we need to acknowledge is that higher education is often steeped in tradition and slow to change. A good example is the fact that it took almost 30 years to take the overhead projector from the bowling alley into the classroom. Yet, we're seeing more and more change in higher education in the recent 5-10 years than we've ever seen before.

Don Tapscott, author of *The Digital Economy* and most recently, *The Rise of the Net Generation: Growing Up Digital*, describes the Internet and interactive technology as they relate to the "baby boom echo," otherwise known as the Net Generation of over eighty million young people—the youngest are currently in diapers and the eldest are just turning 21 years old. What makes this generation different from all others before it is that this generation is the first to grow up surrounded by digital media, so for the first time in history, children are more comfortable, knowledgeable, and literate than their parents about an innovation so central to society.

At the League for Innovation, we fondly refer to the Net Generation as the "Dot Commies Are Coming!" This new generation views technology as an appliance, and use it for entertainment, learning, communication, and shopping. When surveyed 77% of this generation report they could not live without their computers, and 92% think technology will improve their educational options. And it's not just the student dot-commies who have high expectations of technology access. Many faculty, administrators, and staff also have increasing levels of technological expectations

Digital Divide

According to the Department of Commerce for Telecommunications (1999), "America's Digital Divide is fast becoming a 'racial ravine." It is now one of America's leading economic and civil rights issues and we have to take concrete steps to redress the gap between the haves and have-nots."

In their recent article focusing on Digital Democracy, Milliron and Miles, the CEO & COO, of the League for Innovation, described this growing issue by stating that "The lack of technology access and skills puts disadvantaged member of our society increasingly at risk of becoming disenfranchised spectators of a digital world that is passing them by, bit by bit."

Clearly, the Digital Divide is a complex and far reaching issue that can't be defined in a simplistic statement. It spans social, political, economic, racial/ethnic, civil rights, and educational lines and is much more than simply providing computer and Internet access.

In 1999, the National Telecommunications Information Administration, the NITA, issued a report called "Falling Through the Net: Defining the Digital Divide." The findings in this report are among the most comprehensive data on the state of the Digital Divide in our country. This report includes data about the percent of U.S. households with computers and access to the Internet by income, race/origin, gender, household, U.S., rural, urban, and center city areas. They report, in part, that:

- African Americans and Hispanics have the least access to computers in their home, particularly in rural areas, and that the lower their family income, the less likely they'll have a computer;

- Blacks and Hispanics use the Internet significantly less at home, particularly in rural areas, and the lower the income level, the lower the Internet use; and

- significant technology challenges exist for minorities and for rural areas, with whites two times as likely to have Internet access as African Americans and Hispanics.

And the Digital Divide is growing. In 1998, the Western Interstate Commission for Higher Education, in association with the College Board, published a report that projects high school graduates by state and race/ethnicity through the year 2012, which projects a 300,000 high school graduate increase by 2012. Between 1995 and 2012, we know that the percent growth of projected high school enrollments is changing significantly. For example, between 1995 and 2012, the projected percent increase for African American high school graduates is 23.9, for American Indians, the percent increase is 75.2, for Asian Americans the percent increase is 93.2, and the largest percent increase of high school enrollments will take place with Latinos with a projected 137 percent increase! While all minority high school enrollments are projected to grow steadily, the White/Non-Latino high school population is projected to experience a 12.5 percent decrease!

In 1998, Fry and Carnevale conducted a study out of the Maricopa Community College District called Generation Y Goes to College: College Enrollments by State 1995 to 2015. In their study, Fry and Carnevale tell us that college enrollments will follow the path of increasing minority high school enrollments. They set the stage by reminding us that between 1989 and 1993, over 20 million births took place which make up the heart of Generation Y, otherwise known as the Baby Boom Echo, the Net Generation, or the Generation DotCommies.

Based on these demographic data, college enrollments will steadily grow! And minority colleges enrollments will follow suit and grow steadily as well! And just like the high school enrollment projections, minority college enrollments will vary, but the college student population will become less white, while becoming more Hispanic and Asian.

So as community college educators, what are we going to do to prepare for the growing number of digitally disenfranchised students that are going to be entering through our open doors?

Digging In

Now is the time for us to move beyond definition and discussion of the Digital Divide, and move to action! The following model programs were captured in a recent League for Innovation Leadership Abstract and serve as the foundation for the League's book, *Access in the Information Age: Community Colleges Bridging the Digital Divide.*

1. Maricopa Community Colleges in the Phoenix area developed "Ocotillo," a faculty-driven, action-oriented "think tank" dedicated to furthering the use of information technology in curriculum and instructional pedagogy to better serve the diverse student population. Some of the basic questions that Ocotillo has addressed and continues to address are:

   - What is the instructional agenda for technology?
   - Who should be in charge of the agenda? Faculty or the techies?
   - What happens as a result of the money spent on instructional technology?
   - What are the benefits for students, particularly those students with limited access to information technology?

2. In the midst of a financial crisis, declining enrollments, and antiquated technology, Tarrant County College District (TCCD) in Texas developed a district-wide technology plan to continuously support and enhance effectiveness in teaching and learning, while addressing support for the information "have-nots." The development of the technology plan included critical input from faculty, staff, administrators, and technical consultants. Once presented to the board of trustees, the board unanimously voted to double the college's maintenance and tax levy, adding an approximate 40 million new dollars to the operating budget each year, with 5 million dollars dedicated to new technology each year. The college district was literally leap-frogging their technological infrastructure and support through this aggressive and forward thinking plan!

3. Humber College of Applied Arts and Technology in Canada developed "The Studio," an instructional support center dedicated to assisting faculty and staff develop and hone a full range of information technology skills, as well as learn how to better teach students with varying ranges of IT aptitude. The Studio sponsors personal computing workshops, customized IT training for groups, individual IT coaching, and IT project support with up to 20 hours of student support to a faculty member.

4. Cuyahoga Community College in Ohio developed what they call the "Strategic Partnership," which is a job candidate feeder group for local

employers to expand the scope of IT workforce development opportunities. One example of this partnership is "TechnoVenture", an innovative computer certification prep camp for youth from economically disadvantaged backgrounds.

We know that numerous examples of outstanding model programs exist in community colleges throughout the country. Yet, we must keep in mind that as we take bold steps toward becoming more technologically sophisticated, we need to come full circle and remind ourselves that learning in the Digital Age is much more than just using technology.

For example, Terry O'Banion, President Emeritus of the League for Innovation, is fond of noting that with the advent of Distance Learning, the Web holds the distressing potential to make bad instruction more widely available. And as many of you have learned first hand, after the "new toy" thrill of technology wears off, the most thoughtful educators find that best practices for the use of technology as a tool for learning correspond to best practices for education and learning in general. So in the midst of fast-paced technological change, we need to remember that using technology as a tool for instructional delivery does not automatically result in effective learning experiences.

Dedication to Education: Learning Beyond Technology

We find ourselves caught in one of the many ironies of the Digital Age: through the pressure to learn about and with technology, we must continuously REMEMBER that we have more opportunities than ever before to touch students by learning BEYOND technology. A recent report from the 21st Century Workforce Commission puts it best by stating that:

> "The current and future health of America's 21st Century economy depends directly on how broadly and deeply Americans reach a new level of literacy—'21st Century Literacy'— that includes strong academic skills, thinking, reasoning, teamwork skills, and proficiency in using technology."

The League for Innovation has been working for more than a year with the Pew Charitable Trusts on the 21st Century Learning Outcomes project, which explores general education curriculum projects nationwide. This project identified eight clusters of critical life skills needed for students to survive and flourish in the Digital Age:

- Technology Skills—acquiring computer literacy and Internet skills, retrieving and managing information via technology
- Communications Skills—reading, writing, speaking, and listening

- Computation Skills—understanding and applying mathematical concepts and reasoning, analyzing, and using numerical data
- Critical Thinking and Problem-Solving Skills—evaluating, analyzing, synthesizing, decision making, and creative thinking
- Information Management Skills—collecting, analyzing, and organizing information from a variety of sources
- Interpersonal Skills—developing teamwork, relationship management, conflict resolution, and workplace skills
- Personal Skills—understanding self, managing change, learning to learn, taking personal responsibility, understanding aesthetic responsiveness and wellness
- Community Skills—building ethical citizenship, diversity and pluralism, and local, community, global, and environmental awareness

These skills, or learning outcomes, were identified and validated by over 260 colleges across the United State and Canada and help us think about the dynamic array of interrelated social, economic, and technological issues and that surround the Digital Divide.

Clearly, the rapid advances of information technology are dramatically changing the way we work, play, learn, and grow. And all of these changes have created a Digital Divide in which economically challenged and minority populations struggle with a significant lack of access to these newly emerging technologies. Yet, it's encouraging that many community college educators are really DIGGING IN and making a difference! Historically, community college educators have always served the "have-nots" in our communities, and that's one of the most impressive characteristics that sets community colleges apart from all other sectors of higher education.

Dedication to Education

In closing, if we hope to bridge the Digital Divide, we need everyone's help, because in order to help ALL of our students be successful in the Digital Age, and throughout our shared Odyssey of Change, we must learn to be either technologically savvy educators or educationally savvy technologists, who understand and practice Learning Beyond Technology!

The Texas Prefreshman Engineering Program: A Best Practice for Achievement

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The Texas Pre-Freshman Engineering Program, or TexPREP, began in 1979 at The University of Texas at San Antonio. It has been conducted as an eight-week, summer mathematics-based academic enrichment program for middle school and high school students interested in science, engineering, and other mathematics-related careers. Since 1979, it has been replicated in 15 Texas cities as TexPREP and it currently operates on 25 community and four-year college campuses. Since 1997, it has been replicated in eight other states on nine college campuses as PROYECTO Access.

The focus of the program is the development of abstract reasoning skills and mathematical problem solving skills. The program combines mathematical learning experiences with mathematical applications in engineering, physics, and computer science. A daily career awareness component of visiting scientists and engineers, many of whom are women and minority, and other professionals enables participants to learn about technological opportunities.

The program staff has developed a PREP start-up kit, which includes an operational manual and a complete written curriculum covering three summers. In a well-structured academic setting, the students are given class homework assignments, projects, and examinations. They are expected to maintain a 75+ average to stay in the program. A normal retention rate in a given summer is 85% to 90%. Program teaching faculty include college professors, premiere middle school and high school teachers, and graduate students. Support services include guidance from undergraduate engineering and science majors who serve as program assistant mentors and from counseling graduate students. High school students from low-income families who have completed three summers of PREP and whose wages are paid by the local Workforce Development Board summer youth programs serve as peer tutors. Low-income participants fourteen years or older receive stipends from the summer youth program and free lunches through the Summer Food Service Program funded by the U.S. Department of Agriculture and the Texas Department of Human Services.

TexPREP is a partnership of at least 200 local, state, and national public and private sector agencies including the State of Texas, NASA, Sid W. Richardson Foundation, Texas Educational Agency, Texas Department of Human Services, Texas Department of Transportation, local Workforce Development Boards, Hispanic Association of Colleges and Universities, 25 community and senior college campuses and local school districts, and other

collaborators. TexPREP charges no tuition or fees to participants. Financial contributions and in-kind manpower and facilities contributions from these agencies meet all program expenses.

PREP Objectives

Some objectives of PREP include improvement of the high school graduation rate, the college entrance rate, and the college graduation rate particularly in science and engineering. Special efforts are dedicated to the recruitment of women and minority students. Over 18,000 middle and high school students have completed at least one summer of TexPREP, and 81% have been minority and 54% have been women. Each site maintains a database on all program participants and conducts an annual follow-up of them until they complete college. In the 1999 follow-up survey, responses were received from 3,828 of 7,756 college age former participants:

- The high school graduation rate is 99.9%.
- 92% are college students (2,200) or college graduates (1,307).
- The college graduation rate of college attendees is 90%.
- 77% of the senior college graduates are minority.
- 53% of the senior college graduates are engineering, mathematics, or science majors.
- 71% of the engineering and science graduates are minority.
- 86% of the college students (1,948) and graduates (1,062) attended Texas colleges.

In 2000, TexPREP served approximately 3,200 students, while PROYECTO Access served 900 more students, most of whom were minority.

When San Antonio PREP first started twenty-two years ago at The University of Texas at San Antonio, the conventional wisdom of the day was that the program was doomed to failure because middle and high school students would never want to spend eight weeks during the summer on a college campus in the study of mathematics and its applications. Furthermore, it was believed that minority students would not succeed in this structured and disciplined environment. Indeed in 1979, an article was published in a San Antonio magazine concerning the establishment of an engineering program at UTSA. An anonymous member of the Texas Higher Education Coordinating Board expressed his opposition to approving an engineering program at UTSA because: "The Mexican American community is not where engineers come from anyway." Twenty-two years of TexPREP operation have belied these assertions.

Although 50% of PREP students have come from economically at risk circumstances, TexPREP has proved that under the guidance of competent and caring teachers, these students can acquire the necessary quality educational

preparation to succeed in college. TexPREP scholars develop abstract reasoning skills and problem solving skills, which will become increasingly important in functioning and thriving in our future technological society.

Lessons Learned

If our people are going to be prepared to function in the mainstream of society and to become future leaders in our increasingly technological society, we must become advocates for an educational philosophy that stresses personal excellence and wholesome intellectual development, and become opponents of the philosophy that makes our children feel good for doing poor or mediocre work.

We must condemn those educational programs and reforms that would substitute the mere acquisition of computer manipulative skills and access to the Internet for intellectual development. We must support programs that stress the acquisition of self-esteem through hard work, commitment, and achievement and oppose those that stress the acquisition of self-esteem as an end in itself.

Indeed, today some students are being victimized by dangerous educational philosophies, which claim to make learning easy and fun. Many years ago, hard work and persistence on the part of our students resulted in their acquisition of basic intellectual tools like reading, writing, and mathematics and their mastery in everyday applications. Today, with the current education fads, our students can't read. Instead stories and instructions are given on user-friendly videotapes. They can't write an error free sentence unless they have access to spell checkers. And they can't do basic computational work unless they have a calculator. In place of teaching, some get entertainment; in place of learning and understanding mathematics, they learn about the calculator applications of mathematics.

Consequently, many of these students, through no fault of their own but rather the fault of our educational system, are doomed to enter dull, entry level jobs with basic high tech applications. Rather than being our future educated productive leaders in our high tech society, their managers and supervisors will be well educated engineers and scientists who are imported from other countries. This prediction is already on its way to fulfillment. Because of the dearth of native born engineers and computer scientists to fill the high technology positions in our national industries, high tech companies have persuaded Congress to allow an increase of the number of immigrants who have skills in these areas. This is a clear recognition that our educational system is denying many of our children access to these interesting and challenging professional opportunities.

Another concern is the educational priorities which our public and private sectors support. Science Magazine dedicated its November 1992 issue to minorities in the science pipeline. One article writer who as a high school student participated in an intervention program commented that we spend too much effort to get students to love science and mathematics instead of preparing them academically to pursue these areas. Indeed, from my own personal experience in obtaining support for TexPREP, some funding agencies seem to be more interested in outreaching to underachieving students through loosely structured experiential programs at the cost of neglecting achieving middle school and high school minority students from poverty level families who still need the intellectual reinforcement offered in enrichment programs to achieve success in college level mathematics-based studies. We should also be concerned about some consequences of efforts to establish state of the art two-year post-secondary high tech vocational programs throughout the country.

Our concern should not be about the need of these programs. We do need these programs particularly for minorities who for one reason or another can avail themselves only to two years in a community college. Our concern should be that our four-year colleges, capable minority students, particularly those who start their college work in a community college, and who come from poverty level families, may be tempted to take the easy way to a good paying job by preparing themselves to become high tech specialists. This is simply a variation on a theme from previous years when our able minority high school students were urged to take vocational courses instead of college preparatory courses, so that they could enter the labor force immediately upon high school graduation. As a result, minority students through the decades have been stereotyped as being incapable of pursuing a rigorous pre-college curriculum. Today, our country is suffering from the effects of this educational bad practice.

TexPREP's Success

Some explanations of the successful TexPREP partnership are the following:

1. TexPREP is a well organized and highly structured mathematics based academic enrichment program, which stresses the development of abstract reasoning skills and problem solving skills. It is not a curriculum driven by the calculator or computer. Rather, technology is used as a tool for learning rather than allowing technology to determine the program content. A written curriculum, developed by San Antonio PREP teachers and students, is available to any prospective site interested in starting a PREP site.

2. TexPREP has high but reasonable expectations of its participants. The program attracts students who enjoy learning and has a zero tolerance for students who do not.

3. The TexPREP staff consists of competent and caring teachers, program assistants, and administrators who have a strong commitment to student achievement, in particular, minorities.

4. TexPREP is an inclusive program which welcomes both minorities and non-minorities. TexPREP has refused to succumb to pressures of becoming an all minority program. TexPREP offers a wholesome interaction for hard working students from all ethnic backgrounds.

5. TexPREP maintains a database on all its graduates. Annual surveys gather information on the current status of its graduates. In particular, annual reports are issued which include the following information:
   (i) high school graduation rate;
   (ii) college entrance and major rate;
   (iii) college graduation and major rate.

6. Each current sponsor and benefactor receives a copy of the annual report. Because of the program results, most sponsors and benefactors maintain their partnership with TexPREP and new sponsors are recruited.

7. As appropriate, sponsors and benefactors receive diskettes and listings as authorized by our graduates to be used for recruitment opportunities in special programs, college entrance, and permanent or temporary employment.

A Call to Action

So what can the public and private sectors do to increase the number of students and the diversity of students who pursue engineering and science careers? I strongly recommend that the public and private sectors identify pre-college programs like TexPREP, which have a proven record of achievement and provide long-term support for their enhancement and replication. According to a 1998 NSF report on bachelor degrees awarded in 1995, 164,395 were in the areas of engineering, physical science, mathematical science, computer science, and biological sciences. Of this number, 20,759 or 12.6% were awarded to African-Americans, Hispanics, or American Indians. This reflects the continuing serious under-representation in the hard sciences and engineering.

Let us now assume that 300,000 middle school and high school minority students could pursue at least one eight week summer of a TexPREP clone, annually. Furthermore, let us assume 150,000 of these students are first year students. Using current TexPREP results, 51,000 of these students would graduate from college annually with degrees in science or engineering. The annual cost for this program would be less than one billion dollars. At the same time, we will have taking major strides in preparing scientists and engineers from our citizenry and at the same time achieving desirable diversity in these professions.

We must also support generous college scholarship programs for low-income high school students, who excel in college preparatory programs in high school, and condemn those programs that would award scholarships to high school students who earn B averages in easy high school courses, but who will eventually fail college. I recommend that priority be given to these students who have participated and excelled in a mathematics, science, engineering or information technology program and demonstrated a commitment to pursue a college level mathematics, science, engineering, or information technology program.

As we do in PREP, we must have high expectations of our students. They will learn that through hard work and commitment, they can become our future educated and productive citizens, masters and not servants of our future technology, and future leaders of our society.

Other Texas Success Stories

I have related the PREP story because I can offer first hand knowledge of what a quality education program can achieve. Now I would like to comment on some other practices most of which occur in my state. The good ones raise the achievement level of students through direct instruction, teacher-led classrooms, intense concentrated academics, and high but reasonable student performance expectations.

They need to be offered to more students, not necessarily to students who score higher on I.Q. evaluations, but to those who are willing to work hard and want to make something of themselves, and have the intellectual capacity and drive to succeed. Very importantly, talented minority students need to be identified and nurtured for these opportunities.

The University of North Texas conducts the Texas Academy of Mathematics and Science for high school juniors and seniors. These students have been identified as hard working and high achieving and focused on becoming scientists and engineers. They receive dual credit toward high school graduation and the first two years of college. The program is limited to 400 students who have mastered Algebra 2 and Geometry. Students from low-in-

come families receive full academic scholarships and campus living accommodations. When they complete the two years at TAMS, these students are welcome to continue their college education at the most prestigious schools in Texas and the United States.

I am a member of the TAMS screening committee and one of my major concerns is that more minority students do not apply to this program. I would fix this by recommending that this program be replicated on at least six other geographically situated college campuses in Texas so that distance would not become a barrier for participation. I know that North Carolina and Louisiana have similar programs. These programs should be replicated all over the country particularly in communities with high minority populations.

Another outstanding program is one conducted by Dr. Max Warshauer, Professor of Mathematics at Southwest Texas State University. This is a rigorous six-week program for high school students who are interested in pursuing an intellectually stimulating and demanding college level course in Number Theory. This program is a replication of one founded by Arnold Ross of Ohio State University over thirty years ago. Many students of the Ross Program have gone on the graduate school and have earned Master's and Doctoral degrees.

In my opinion, school districts should be encouraged and given funding incentives to establish more magnet middle and high schools focused on areas like mathematics, science, and foreign languages. Again, able minority students need to be identified for these programs.

Also, all schools should offer enrichment, advanced, or honors courses in mathematics and other academic areas for students who can meet the intellectual challenges. Indeed, I would propose that all school districts should offer a high school academic honors program, which requires the completion of at least Calculus and Physics. Furthermore, a necessary condition for earning graduation honors, like valedictorian or salutatorian, is the successful completion of this academic honors program.

Through the years, I have heard about educational programs in some schools which encourage the mastery of a second language. Indeed, rather than foster an English only mentality, I should hope that our institutions- educational, business, legislative- would promote an English+ environment. Some beneficial effects in learning a second language would include intellectual broadening and a feeling of accomplishment, appreciation for other cultures, and a mastery of the English language and its uses.

Our country needs to attract very talented individuals to the teaching profession. I

submit that entry-level salaries for beginning teachers should be at least comparable with corresponding salaries for engineers and scientists. Indeed, salaries for outstanding elementary teachers should be offered and these teachers, in the words of Liping Ma, need to possess "A profound understanding of fundamental mathematics." Our young children are deserving of the best teachers who will help them develop an appreciation for learning and scholarship so necessary for a future productive and fulfilling life.

"It's time to recognize that, for many students, real mathematical power, on the one hand, and facility with multi-digit, pencil-and-paper computational algorithms, on the other, are mutually exclusive. In fact, it's time to acknowledge that continuing to teach these skills to our students is not only unnecessary, but counter productive and downright dangerous." Fortunately, I do not take credit for this comment. Rather, Steven Leinwand, who was the co-chair of the U.S. Department of Education Expert Panel on Mathematics and Science Education of which I was a member, is the author of these remarks.

At least ten mathematics programs reviewed by several layers of committees were ultimately designated as exemplary or promising. These designations in my opinion have been rightfully disputed by the Mathematically Correct Group of California and by a number of other eminent mathematics and science scholars.

Another source that refutes this mentality in learning mathematics is the National Council of Teachers of Mathematics Principles and Standards for School Mathematics, published in April, 2000. Here are some quotations from the new NCTM Standards: "Students should be able to compute fluently. However, when teachers are working with students and developing computational algorithms, the calculator should be set aside to allow this focus." Also, "Technology should not be used as a replacement for basic understandings and instructions." Another notable citation from the NCTM Standards is the following: "By the end of secondary school, students should be able to understand and produce mathematical proofs-arguments consisting of logically rigorous deductions of conclusions from hypothesis- and should appreciate the value of such arguments. Reasoning and proof should be a consistent part of students' mathematical experiences in pre-kindergarten through grade 12."

Unfortunately, at least one Urban Systemic Initiative in Texas downplays the importance of middle school mathematics teachers to understand and do mathematical proofs. If our teachers cannot do mathematical proofs, how can they develop this skill in our students? Although some of my mathematical colleagues still remain skeptical about the new NCTM Standards, I believe the new Standards is a significant forward step in defining excel-

lence in mathematics teaching.

At the same time to achieve the aforementioned goals, I am also convinced and some research strongly suggests that direct instruction and teacher led instruction must be emphasized over discovery learning and cooperative student-centered instruction. Furthermore, the curriculum should emphasize learning the structure of mathematical systems with a balance of computation, understanding, and problem solving. I look forward to the day that our political leaders and in general our fellow citizens can simultaneously boast about the excellent quality of educational opportunities available to and affordable for all our children and the downsizing of our penal system.

Let me conclude this presentation with an incident, which reflects the impact of TexPREP directly on me. About two years ago, as I was walking from my parking space at UTSA to my office, I experienced a tightness in my chest which extended to my right arm. When I arrived in my office I called my physician who advised me to report to the San Antonio Downtown Baptist Hospital Emergency Room. Upon my arrival, they took an electrocardiogram and found no damage. A few minutes after I was assigned a bed, a young staff cardiologist came to me and said: "My name is Jude Espinoza. You may not remember me. But I was in the 1981 PREP program." The next day Dr. Espinoza assisted in an angioplasty on me. Perhaps, I need to thank Jude and PREP that I am able to share this day with you.

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